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(54) **IC CARD SYSTEM.**

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Description

Technical Field

A microfiche appendix containing 145 frames on 2 cards is included in the specification and is hereafter referred to as Appendix I.

Background of the Invention

The present invention relates to an integrated circuit (IC) information card system using a card having an integrated circuit chip or chips including a programmable processor and a nonvolatile read/write memory for storing data and access codes needed to access the data.

Various types of information cards have been developed which include storage media for storing information identifying the user of the card and other information. One such card is the ordinary plastic credit card or identification card which has embossed lettering on the card to indicate the identity of the holder, an identification or account number and possibly other information. In addition, the ordinary plastic credit or identification card has on its backside a magnetic stripe for magnetically storing data. The data stored on the magnetic strip typically verifies the embossed information on the front of the card and includes additional information. Such magnetic stripe plastic cards, while inexpensive to manufacture and issue, provide relatively little security against unauthorized or fraudulent access to the information stored on the exposed magnetic stripe, since such information can be easily read or altered using commonly available equipment. Furthermore, the recorded data on the magnetic stripe may be distorted or destroyed by dirt, scratches or contact of the magnetic stripe with magnetic materials . Moreover, the capacity of such a magnetic stripe plastic card is limited to about 0.5K bits to 1.7K bits, or about 70 to 200 alphanumeric characters.

Another type of card, known as the laser card, is similar to the magnetic-stripe plastic card but replaces the magnetic stripe with a stripe of reflective material. Information is stored in the laser card by burning microscopic holes in the surface of the reflective stripe with a focused, low-power laser. Although the laser card is capable of very high data storage capacities of up to 1 million bits, it also does not provide adequate protection against unauthorized access to the data stored in the exposed reflective stripe, which can be easily read or written using the proper equipment.

Yet another type of information card incorporates integrated circuit memory of either the read only and the write/read variety. Such a memory card typically has multiple electrical contacts located at one or more edges of the card or on a face of the card to permit electrical access to the address, data and any control terminals of the memory in the card. However, such memory cards generally provide relatively little or no protection against unauthorized access to the data stored in the card, since the contents of the card memory can, in most cases, be easily read out or added to with the proper equipment. Further, some memory cards use volatile memory requiring a costly, built-in, power source in the card to prevent loss of the data stored in the card memory. The foregoing deficiencies of memory cards have essentially limited their use.

Still another type of information card, known as the wired-logic card, incorporates an integrated hard-wired logic circuit together with nonvolatile integrated circuit memory to provide improved security for the data stored in the memory. In such a card, access to the memory may be entirely under the control of the hard-wired logic circuit, which may require the entry of a secret code or key before access to the memory is permitted. Owing to the limited processing capability of the hard-wired logic circuit, the wired-logic cards have been limited to relatively simple applications, such as for telephone payments and records.

The latest generation of information cards, which are commonly referred to as "intelligent" or "smart" cards, includes a programmable integrated circuit processor together with nonvolatile integrated circuit memory within the card. Since the programmable processor provides greatly expanded processing capabilities, the card may incorporate a sophisticated security system to prevent unauthorized or fraudulent access to some or all of the data stored in the card memory.

One such security system is disclosed and claimed in U.S. Patent No. 4,211,919 to Michael Ugon, which issued on July 8, 1980. In that security system, the card memory is segmented into three particular zones, namely: a secret zone in which reading and writing operations are permitted only by the internal processor of the card; a working zone in which reading and writing operations are permitted directly by an external card reader/writer device; and a read zone in which only reading operations are permitted directly by the card reader/writer device. The secret zone of the card memory includes at least one key or code which is compared to a key received from a card reader/writer device to determine whether a particular

access operation to the working zone is authorized.

The above-described card security system has the problem in that data segments of the working zone may be defined only in the application program of the host computer of the card system, therefore adding to the complexity of such an application program. Furthermore, all data in the working zone have only a single security level for reading and writing operations, respectively, i.e., with the entry of the proper key or combination of keys the entire working zone may be read or written.

In many applications for information cards, it is desirable to have the flexibility of being able to define the data zones of the card memory within the card itself and of being able to assign different security levels for reading or writing operations in the various data zones to suit the particular application. For example, in a health care application where the card is used to store data concerning a health care recipient, it would be appropriate to restrict access to certain categories of data only to particular classifications of health care personnel (e.g., doctors, pharmacists, etc.) and to similarly restrict the authority to add or alter the data in the card memory. Therefore, it is desirable to store the various categories of data concerning the health care recipient in different zones of the card memory as defined within the card and to assign an appropriate access security level, based on one or more access keys, for reading and writing operations to each data zone.

Accordingly, a need clearly exists for an IC card structure and method in which the card memory may be segmented into a desired number of data zones after this card is manufactured and in which each data zone of the card memory may be assigned a respective security level, based on one or more access keys, for reading or writing operations in that zone. A system using an IC card and method may advantageously include provisions for preventing the dissemination of knowledge of the access keys or combinations of such keys which define the security levels for the data zones of the card memory and for initializing the cards (i.e., defining the data zones of the card memory, assigning respective security levels to each data zone and loading the proper data into the various data zones card of the care memory) for each application on a mass production basis.

From EP-A-0 152 024 an IC information card is known which comprises input/output means in the card for receiving at least data, commands and keycodes; nonvolatile memory means having a multiplicity of addressable bit storage locations; means within the card responsive to zone definition data and a keycode stored in the card to allow access to predetermined zones if an entered received keycode matches the keycode stored in the card. A zone access controller stores a password and an access condition for each zone in the memory.

A similar IC card is known from US patent specification 4,211,919. This IC card has memory means in the card having different zones with different access conditions. At least one zone of the memory includes at least one key or code which is compared to a key received from a device external to the data carrier to determine wheher a particular operation is authorized.

From US patent specification 4,211,919 there is further known an initialisation system for IC information cards known from EP-A-0 152 024.

Summary of the Invention

In accordance with the present invention, an IC information card, systems for using and initializing such cards and methods for segmenting the card memory and for preventing the dissemination of knowledge of access codes are provided which overcome or at least mitigate the limitations and problems of the prior art as described above.

The IC information card in accordance with the present invention comprises input/output means in the card for receiving at least data, commands and keycodes and for providing at least data. In addition, the card includes nonvolatile read/write memory means within the card, the memory means having a multiplicity of addressable bit storage locations. Furthermore, the card includes first means within the card responsive to a first command, zone definition data and an entered keycode received by the input/output means for comparing the entered keycode with a first keycode stored in the card and for writing the zone definition data in a first region of the memory means only if the received keycode matches the first keycode, the zone definition data comprising one or more zone definition words each corresponding to a respective data zone in a second region of the memory means, each zone definition word specifying at least the starting address of the corresponding data zone and the size of the corresponding data zone.

Security levels may be specified for each of the data zones by providing the card with second means responsive to a second command, keycode data comprising one or more additional keycodes and an entered keycode received by the input/output means for comparing the entered keycode with the first keycode and for writing the additional keycodes in a third region of the memory means only if the entered

keycode matches the first keycode, and having each zone definition word further specify either no keycode or one or more of the first keycode and the additional keycode or keycodes as being required to be received by the input/output means in order to read data from the corresponding zone and either no keycode or one or more of the first keycode and the additional keycode or keycodes as being required to be received by the input/output means in order to write data in the corresponding data zone.

In the preferred embodiment of the IC information card there is provided a third means within the card responsive to a read command, a code specifying a particular one of the data zones from which data is to be read and any entered keycode or keycodes received by the input/output means for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to read data in the particular data zone for providing data from the particular zone to the input/output means if the entered keycode or keycodes match the keycode or keycodes specified as being required to read data from the particular data zone or if no keycode is specified as being required to read data from the particular data zone. Also provided in the preferred embodiment is a fourth means within the card responsive to a write command, a code specifying a selected one of the data zones in which data is to be written, data is to be written in the selected zone and any entered keycode or keycodes received by the input/output means for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to write data in the selected data zone and for writing the received data in the selected data zone if the entered keycode or keycodes match the keycode or keycodes specified as being required to write data in the selected data zone or if no keycode is specified as being required to write data in the selected data zone.

Moreover, in the preferred embodiment of the IC information card data is stored in each data zone as successively located data records and each zone definition word further specifies the maximum number of data records that can be stored in the corresponding zone, the length of the data in each data record in the corresponding zone and a zone allocation area in the memory means for storing data indicative of the location of the next data record to be stored in the corresponding zone. Each data record stored in a data zone includes a checksum byte and a record status byte indicative of the validity of the data record. In addition, each zone definition word further specifies whether the data provided to the input/output means by the third means in response to a read command and a code specifying data to be read from the corresponding zone is only the last data record to be written in the corresponding zone or all data records that are stored in the corresponding zone in the order in which such data records are written in the corresponding zone.

An additional feature of the preferred embodiment of the IC information card in accordance with the present invention is the "locking" of the card after a specified number of successive unsuccessful attempts to access the card. This feature is implemented in the following manner. The memory means further contains a plurality of successively ordered lock status words, including a first and a last lock status word, each lock status word having a predetermined number of successively ordered bit positions, including a first and a last bit position, each bit position of each lock status word being initially in a second binary state. Additionally, the card further comprises fifth means within the card responsive to a failure of an entered keycode to match a keycode stored in the card, as a result of a keycode comparison made by the first, second, third or fourth means, for writing a first binary state in the lowest order bit position that is in the second binary state of the lowest order lock status word in which the highest order bit position is in the second binary state. The fifth means is responsive to a match of an entered keycode with a keycode stored in the card occurring directly after a failure of an entered keycode to match a keycode stored in the card, as a result of a comparison made by the first, second, third or fourth means, for writing a first binary state in the highest order bit position of the lock status word in which a first binary state was written by the fifth means in response to the directly preceding failure of an entered keycode to match a keycode stored in the card. The card further comprises sixth means within the card responsive to a lock status word having all but its highest order bit position in the first binary state for placing the card in a locked state in which at least reading and writing access to the first and second regions of the memory are prevented. Lastly, the card includes seventh means within the card responsive to an unlock command and one or more entered keycodes for comparing the entered keycode or keycodes with preselected keycode or keycodes stored in the card and for writing a first binary state in the highest order bit position of the lock status word having all but the highest order bit position in the first binary state to release the card from the locked state, if the entered keycode or keycodes match the preselected keycode or keycodes.

In the preferred embodiment of the IC information card in accordance with the invention, the first, second, third, fourth, fifth, sixth and seventh means are included in an appropriately programmed microprocessor operatively coupled to the input/output means, and the memory means includes a programmable read-only memory operatively coupled to the microprocessor.

The above-described IC information card in accordance with the invention is advantageously used in conjunction with two-card reader/writer means having a first and a second port for receiving a first and a second card, respectively, and for coupling to the input/output means thereof, coupling means for receiving at least commands, data and keycodes and for providing at least data, and reader/writer memory means. The reader/writer means further includes first means responsive to the coupling means receiving a command to read the second card, a code specifying a particular zone in the second card from which data is to be read and any keycode or keycodes to be entered in the first card, for providing to the input/output means of the first card one or more read commands together with a code or codes specifying the data zone or zones of the memory means of the first card where the keycode or keycodes required to read data in the particular zone of the second card are stored and any keycode or keycodes received by the coupling means. The first means then transfers such required keycode or keycodes to the reader/writer memory means if the keycode or keycodes received by the coupling means match the respective keycode or keycodes that are required to read the one or more data zones of the memory means of the first card or if no keycodes are required to read such data zones. Thereafter, the first means provides to the input/output means of the second card the read command, a code specifying the particular data zone and the keycode or keycodes for reading data in the particular zone transferred from the memory means of the first card to the reader/writer memory means and transfers any data provided by the input/output means of the second card to the reader/writer memory means.

The two-card reader/writer means also includes second means responsive to the coupling means receiving a command to write to the second card, a code specifying a selected zone in the second card in which data is to be written, data to be written in the selected zone and any keycode or keycodes to be entered in the card for providing to the input/output means of the first card one or more read commands together with a code or codes specifying the data zone or zones of the memory means of the first card where the keycode or keycodes required to write data in the selected zone of the second card are stored and any keycode or keycodes received by the coupling means. The second means then transfers such required keycode or keycodes to the reader/writer memory means if the keycode or keycodes received by the coupling means match the respective keycode or keycodes that are required to read the one or more data zones of the memory means of the first card or if no keycodes are required to read such data zones. Thereafter, the second means provides to the input/output means of the second card the write command, a code specifying the selected zone, the data to be written in the selected zone and the keycode or keycodes required for writing data in the selected zone transferred from the memory means of the first card to the reader/writer memory.

Thus in accordance with the present invention, by using the IC information card with two-card reader/writer means in the foregoing manner, dissemination of knowledge of the keycodes required to access the data zones of a card is avoided. In the preferred embodiment, the first card includes a data zone storing an identification code unique to that card. The identification code of the first card is read by the reader/writer means and stored in the reader/writer memory following initial insertion of the first card into the reader/writer means. The identification code in the first card is read again and compared with the identification code stored in the reader/writer memory means prior to each read or write access of the second card. If the identification code which is read prior to an access of the second card fails to match the identification code stored in the reader/writer memory means, access of the second card is prevented.

Further in accordance with the invention, the above-described IC information cards are initialized by a initialization system that includes input means for receiving one of the cards at a time to be initialized and for coupling to the input/output means of the card received thereby and initializer memory means for storing the first keycode, appropriate zone definition data and additional keycode or keycodes. In addition, the initialization system includes first initializer means for writing the zone definition data stored in the initializer memory means to the first region of the memory means of the card received by the input means using the first command, and the first keycode stored in the initializer memory means. Furthermore, the initialization system includes second initializer means for writing the additional keycode or keycodes stored in the initializer memory to the third region of the memory means of the card received by the input means using the second command, and the first keycode stored in the initializer memory means.

The initialization system in accordance with the preferred embodiment of the invention is also used to load the data zones of the IC information card with appropriate data to suit a particular application. This is accomplished by providing the card with second memory means, such as a magnetic stripe, for storing a file identification code and the initialization system with means for reading the second memory, such as a magnetic stripe reader, for obtaining the file identification code of a card received by the input means of the system. Additionally, the initialization system includes mass storage means for storing a multiplicity of data files each associated with a respective file identification number, each data file having a plurality of data

segments corresponding to respective data zones of a card as defined by the zone definition data written into the card by the first initializer means. There is further included third initializer means responsive to the file identification code obtained by the means for reading the second memory means for searching the data files in the mass storage means for the data file associated with that file identification code. The initialization system further includes fourth initializer means for writing the segments of the associated data file into corresponding data zones of memory means of the card received by the input means using the write command and appropriate keycode or keycodes, if any, required for writing data in each corresponding data zone.

There is further provided according to the present invention a method for segmenting the data storage region of the IC card memory into a plurality of segments, each having assignable attributes including an assignable security level and a method for preventing the dissemination of knowledge of the access codes for an IC information card by storing such codes in a control card and using two card read/writer means.

Numerous other advantages and objects will appear to those skilled in the art with reference to the following detailed description of the invention, the appended claims and the accompanying drawings.

Brief Description of the Drawings

Figure 1 is a block diagram of the IC information card system in accordance with the invention;
Figure 2A is a plan view of the IC information card in accordance with the invention;
Figure 2B is an elevated cross-sectional view of the IC card of Figure 2A taken along line 2B-2B;
Figure 3 is an electrical schematic diagram of the CPU and EPROM of the IC information card in accordance with the invention;
Figure 4 illustrates the memory map of he memory in the IC information card in accordance with the invention;
Figure 5 illustrates the record status byte of a data record;
Figure 6 illustrates the security level definition portion of a zone definition word in the memory of the IC information card in accordance with the invention;
Figure 7 shows a memory map depicting the test address, system and user areas, as well as the relationship between physical and logical addresses of the IC information card memory in accordance with the invention;
Figure 8 shows a memory map depicting the security management area, the zone definition area and the data area of the IC information card memory in accordance with the invention;
Figure 8A shows a memory map depicting the organization of a single data zone of the IC information card memory in accordance with the invention;
Figure 9 is a flow chart showing the IC information card operation generally upon receiving a command from the reader/writer;
Figure 10 is an block diagram of the IC information card reader/writer in accordance with the invention;
Figure 11 is an schematic diagram of the interface circuit for the card transport unit for the IC information card reader/writer of Figure 10;
Figure 12 and Figure 13 together show the schematic diagram of the IC information card reader/writer of Figure 10;
Figure 14 shows the memory map of the ROM and RAM of the IC information card reader/writer of Figure 10;
Figure 15 shows in block diagram form the configuration of software for the IC information card system in accordance with the invention;
Figure 16 shows a block diagram of the IC information card initializer system in accordance with the invention;
Figure 17 shows a memory map depicting the general organization of a master card for the IC information card initializer in accordance with the invention;
Figures 18 through 22 show flow diagrams representing the initializer program flow in accordance with the invention;
Figures 23 through 39 show the command protocols of the BIOS program of IC information card reader/writer in accordance with the invention;
Figures 40A and 40B show flow diagrams representing the IC information card reader/writer application program process flow in accordance with the invention;
Figures 41 through 91B show the flow charts of the program of the microprocessor of the IC information card in accordance with the invention; and

Figures 92 through 107B show the communication protocols for the commands of the program of the IC information card initializer in accordance with the invention.

Detailed Description of the Preferred Embodiments

As shown in Figure 1, the IC card system 100 according to the invention comprises an IC card 10, connected via its contacts 24 to corresponding contacts in a reader/writer (R/W) 14. The system also comprises a host computer 16 connected to the reader/writer 14 by an electrical link 18, which may comprise an RS-232C communications link. The host computer 16 may be an IBM Model XT. As will be described below, the reader/writer 14 has two receptacles or ports for receiving up to two IC cards 10 simultaneously. The individual components of the system will now be described in more detail.

IC CARD

The IC card 10, as shown in Figs. 2A and 2B is preferably the same general size as a conventional magnetic stripe credit card having a size 54 by 86 by 0.76 mm. The IC card has a magnetic stripe 19 and contains a CPU 20 and nonvolatile memory in the form of a PROM or EPROM 22. Alternatively, a storage device such as an EEPROM, i.e. an electrically erasable programmable read only memory, can be used as the storage device. The IC module comprising the CPU 20 and EPROM 22 is enclosed in the card 10 using a between-layers lamination method known to those skilled in the art.

The IC module is electrically connectable to the reader/writer 14 by means of eight terminals C1 through C8 as shown in Figure 2A. The card size as well as the electrical terminals C1 through C8 are designed to comply with ISO (International Organization for Standardization) standards for IC cards. These standards provide essentially for eight terminals C1 through C8 located and positioned in the arrangement shown in Figure 2A with the dimensions of each terminal being 2.0 by 3.9 mm and edge to edge vertical and horizontal spacings of 0.54 mm and 7.62 mm, respectively. The terminals C1 through C8 are adapted to engage corresponding contacts (not shown) in the reader/writer 14.

Figure 3 shows in more detail the electrical connections between the terminals C1 through C8, the CPU 20 and the EPROM 22. The CPU may be a model 8049 8-bit microprocessor. The EPROM may be a model 2764 C with a storage capacity of 64K bits, (i.e. 8K bytes). Electrical connections between the CPU 20 and EPROM 22 include a control bus 26 comprising two lines, an address bus 28 comprising 13 lines, and a data bus 30 comprising 8 lines. Although the particular embodiment shows CPU 20 and EPROM 22 as separate IC chips, it is to be understood that equivalents of those two components may be fabricated on a single IC chip.

With respect to the C1 through C8 and with reference to Figure 3, terminal C1 is designated VCC and provides the power (+5 volts) to the CPU and memory. Terminal C2 designated RST is the reset terminal of the CPU. Terminal C3 designated CLK is the clock terminal of the CPU. Terminal C5 designated GND is the ground. Terminal C6 designated VPP is the read/write power terminal of the EPROM (although in some embodiments the single 5 volt power source C1 may accomplish this purpose). Terminal C7 designated I/O is the data input/output terminal for communicating data to and from the reader/writer. Terminals C4 and C8 are not presently used in the exemplary card.

IC CARD MEMORY

A unique feature of the present invention is in providing a user (data) memory area in the EPROM 22 of the card which can be selectively divided into a number of zones, each of which may be selectively accessed (for reading, writing or both) if a key or password code entered into the card by its user permits such access for that particular zone.

The memory of the IC card will be described with reference to Figure 4 which shows ~~the data area of~~ an IC card memory ~~being divided into a plurality of zones,~~ which can be ~~from 1 to 255 in number.~~ Each zone is further divided into ~~a zone allocation area~~ and a number of records from 1 to 255. Each record is further divided ~~into three segments,~~ the first being the segment where the ~~data are stored, the~~ second being ~~a check byte~~ and the third being a ~~record status byte~~. The length of the records can be selectively defined by the user to be up to 253 bytes, so that the total size of the data record will be up to 255 bytes, with the ~~check byte (CB) and record status byte (SB) included~~.

The check byte (CB) is used to detect distorted data in a data record. When a data record is written, the IC card calculates a value using this data by, for example, a check summation using the complement of 2 method, and writes this value into the check byte space. When a record is read, the IC card checks the

integrity of the data by performing the same calculation and by comparing the calculated value to the value stored as the check byte. The record status byte (SB) is used for defining record attributes such as data validity and is read or written using the record status byte write-read commands of the IC card program.

ZONE DEFINITION

The attributes of each zone are defined by writing a zone definition table into the EPROM of the IC card. The following zone attributes may be defined for each zone:

1) record length (number of bytes)
2) number of records
3) security level
4) UPDATE/HISTORY.

(a) Record Length

The length of data per record is expressed as the number of bytes in the record. The shortest record permitted is one byte, and the longest record permitted is 253 bytes.

(b) Number Of Records

The number of records in each zone may range from 1 up to 255.

(c) Security Level

This attribute relates to the access level at the time of writing or reading a record. The IC card normally requires one or two keycodes corresponding to the security level defined for a zone to be entered into the card before reading or writing of data in the zone is permitted. If a keycode stored in the IC card for a particular zone does not match the code entered from an external source (e.g., an IC card reader/writer), data cannot be read or written in that zone. The security control functions of the IC card in accordance with the present invention will be explained in further detail hereinbelow.

(d) UPDATE/HISTORY

This attribute relates to the mode of reading data from a zone. When a zone is defined as "UPDATE", only the most recently written record in the zone is obtained when the zone is read. If a zone is defined as "HISTORY", all records in the zone are obtained in the sequence in which they were written when the zone is read. Whether to define a particular zone as an UPDATE zone or a HISTORY zone depends on the user application.

DATA READ/WRITE

(a) Data Write

Data is written sequentially in a zone in units of records. For example, if in Zone No. N data has been written up to Record No. 1, additional data is written in Record No. 2.

(b) Data read

Data records are read out of only one zone at a time. The method of reading data records depends on whether the zone is defined as UPDATE or HISTORY. If the zone is defined as UPDATE, only the last written record in the zone is read. In the above example, Record No. 2, which was the last to be written, is read if zone No. N is defined as UPDATE. If the zone is defined as HISTORY, all records in the zone are read in the sequence the records were written. In the above example, data is read from zone No. N in the sequence of Record No. 0, Record No. 1 and Record No. 2 if that zone is defined as HISTORY.

(c) Record Status Byte

The configuration of record status byte is shown in Fig. 5. Each of the bits M0 through M7 of the record status byte can be given a special meaning in the data record. The meaning of each bit must be defined in advance by the system application that uses the IC card. The M7 bit is normally used to indicate "record deletion" or "unnecessary record". The record status byte can be written or read by issuing an appropriate command to the IC card.

KEY CODES (PASSWORD CODES)

This IC card needs a password code when writing or reading data in the card memory, in order to avoid unauthorized use of the card. The password code is not needed in applications that do not require security as will be described hereinbelow.

There are the following four types of keys or password codes:

1) Manufacturer's key (M-key)	8 bytes
2) Personalization key (P-key)	8 bytes
3) Organization key (O-key)	8 bytes
4) PIN	4 bytes

(a) Manufacturer's Key (M-Key)

The M-key is defined in the mask program of the microprocessor of the IC card. Therefore, it cannot be read externally by any means. The M-key is a password code consisting of 8 bytes and is specified by the manufacturer prior to the manufacture of the IC. The M-key must be controlled by the manufacturer and the system user and should not be made known to the IC card user. The M-key is used only for internal diagnostic activities within the card. (The system user mentioned here means the party who issues the initialized cards to user organizations.)

(b) Personalization Key (P-Key)

The P-key is defined in the mask program of the microprocessor of the IC card. Therefore, it cannot be read externally by any means. The P-key is a password code consisting of 8 bytes and can be specified by the system user upon request prior to the manufacture of the IC card. The P-key must be controlled by the system user and should not be made known to the IC card user. The P-key is used on the following occasions:

(1) to write an organization key;
(2) to write a PIN key;
(3) to write zone definition tables; and
(4) when the system user uses a specific zone for himself.

(c) Organization Key (O-Key)

The O-key is a eight-byte password code that the system user can define after the card is manufactured. When combined with a PIN code, the O-key can provide an additional level of security for the card. Although the O-key can be used in a variety of ways depending on the application, it is normally used as a higher level key than the PIN key. The O-key is stored in the EPROM of the IC card. The O-key may also be used to write the PIN key in the EPROM.

(d) PIN Key

The PIN (Personal Identification Number) key is a four-byte password code that the system user can define after the card is manufactured. As in the case of the O-key, this key can also be used in a variety of ways by the application, but the common use of the PIN key is as a private password code of the IC card user. The PIN key is also stored in the EPROM of the IC card.

SECURITY CONTROL FUNCTION

(a) Security Level

The security level of each zone is defined in the zone definition table. The term "security level" as used herein means the key or combination of keys among those defined (P-key, O-key and PIN) that are required to perform a read or a write operation in a particular zone. Reading and writing operations for a given zone may have different security levels. A 6-bit portion of a zone definition word used to define the security levels for reading and writing in a particular zone and the codes defining the various security levels in accordance with the invention are illustrated in Figure 6.

The different levels of security that are available in the IC card according to the present invention and the key or keys necessary for each security level are summarized in Table A.

TABLE A

Security Level	Necessary Key(s)
0	Access disabled
1	PIN
2	O-key
3	PIN or O-key
4	PIN and O-key
5	P-key
6	Undefined
7	No key required

(b) Card Lock

As explained above, the IC card requires a password code or codes as defined by the zone definition table in order to read or write in a zone. If an entered key does not match a required key three times in succession, the card is "locked" or disabled from further use. The "lock" function applies to all IC card operations (e.g., writing of a Pin or O-key, reading or writing of a zone definition table, reading or writing of a record status byte, etc.) where a key is needed and is not limited only to the reading or writing of a data record.

(c) Card Unlock

Once locked, the card cannot be used. However, it can be made usable by issuing an "UNLOCK" command to the card. Before unlocking a card, it must be carefully determined whether the cause for locking the card was a simple error in memorizing a required key on the part of the card user or an attempt at an unauthorized access of the card. The O-key (or P-key) and the PIN key are both needed to unlock a card. The unlock function can only be performed up to 486 times on a single card.

MEMORY MAP

Figure 7 shows the memory map of an IC card according to the present invention. The card has an EPROM. The 64k-bit memory consists of the following three areas:

1) test address;
2) system area; and
3) user area.

(a) Test Address

This is a physical address. Addresses 0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048 and 4086 are used for testing at the time of manufacturing or during use of the IC card. During such testing the data of 00H, 11H, 22H, 33H, 44H, 55H, 66H, 77H, 88H, 99H, AAH, BBH, CCH and DDH are written sequentially into

the test addresses. If the test data cannot be read or written correctly to each test address, a hardware failure is indicated.

(b) System Area

This area is used by the manufacturer of the card and is not in general available to either the system or card user. This area is used to check the card function, to control the card and to extend the application. The size of this area is 119 bytes.

(c) User Area

This area stores user data and has a size of 8058 bytes. This area is specially defined as "logical address".

Logical address = 0 - 8057 (1F79H) (1)

Unless otherwise specified, the term "address" as used herein means a "logical address".

IC CARD FORMATTING OR INITIALIZATION

Prior to reading or writing a data record in the IC card memory, the memory must be formatted (initialized) to correspond to a particular application for the IC card system. The formatting of the IC card memory consists of the following two operations:

1) writing of key codes; and
2) writing of a zone definition table.

(a) Key Code Write

The PIN key (4 bytes) and the O-key (8 bytes) must be written into the IC card memory. If the respective security levels of all zones are defined as "No Key Required", there is no need to write the PIN and O-key into the card. Once written in, the PIN key and the O-key cannot be changed.

(b) Write Zone Definition Tables

As described above, the zone definition attributes are as follows:

1) record length;
2) number of records;
3) security level (for writing and reading); and
4) UPDATE/HISTORY data record read mode.

In addition to the above, the following additional zone definition attributes must also be defined:

5) zone starting address; and
6) number of allocation bytes

A zone definition word for each zone written into the IC card memory is 6-bytes in length containing codes representing the above six attributes.

Figure 8 shows the memory map of an IC card at the time of zone definition. The security management area 705 of the IC card memory is used to store information for detecting unauthorized use of the card. The area 705 also includes three status bits which respectively indicate whether the PIN key and the O-key have been written and whether the zone definition area 706 has been closed. The PIN and O-keys themselves are stored in memory area 705.

The remainder of the security management area 705 (243 bytes) is divided into 486 4-bit nibbles. These nibbles are used one at a time for recording unsuccessful attempts to access the IC card memory. Each time an entered key does not match a required key, the next successive nonzero bit of the current nibble being used to record unsuccessful access attempts is set to zero. When the three lowest order bits of the current nibble are all set to zero, the card is "locked". The card may be "unlocked" by setting the highest order bit of the current nibble to zero. An access in which the entered key matches the required key resets the count. If the current nibble has recorded any unsuccessful access attempts, all bits of the current nibble are set to zero. The unlocking or resetting of the card causes further unsuccessful attempts to be recorded in the next successive nibble.

Figure 8A shows the memory map of an individual zone 707 as indicated on Figure 8. Each zone includes an allocation area 721, which is used to store information as to which records in the zone have been written. The bits within the allocation area 721 are used to keep track of the next available record to be written. The lowest order bit of the first byte of the zone allocation area 721 is set to zero when the first record 725 of the zone is written. The next lowest order bit in the first byte of the zone allocation area 721 is set to zero when the second record 726 of the zone is written. The process continues as each successive record is written, setting a respective bit for each record, until the maximum number of records, as specified in the zone definition word 703 for that zone, is written. When the last allocated record 727 is written, no further records may be written to the zone 707, although the data in the zone may still be read. In the present exemplary embodiment the zone allocation area for each zone is located within the zone itself. However, in some instances it may be desirable to locate the zone allocation areas for all the zones together in a separate area of the card memory.

The check byte (CB) 723 has already been discussed in connection with Fig. 4. The status byte (SB) 724 has already been discussed in connection with Figures 4 and 5.

Up to 255 zones may be defined in the IC card memory. Since the starting address of a zone is stored in the zone definition word, there may be unused memory space between the end of the zone definition table area and the start of the first zone. A similar unused memory space may exist between two adjacent zones.

(c) Zone size

The size of Zone No. "n" (expressed as L(n)-number of bytes) is calculated using the following formula:

$$L(n) = m(n) \times (1(n) + 2) + m(n)/8 \qquad (2)$$

where l(n) is the record length in number of bytes and m(n) is the number of records. Decimal fractions are rounded to the next higher integer.

(d) Zone Address Calculation

Assuming that the number of zones to define is M, that the same address is not used for two or more places and that no unused memory space exists, the start address S(N) of the N-th zone is calculated as follows:

$$S(N) = \sum_{n=1}^{N-1} L(n) + 6M + 256 \qquad (3)$$

The end address E(N) of the N-th zone is calculated as follows:

$$E(N) = \sum_{n=1}^{N} L(n) + 6M + 255 \qquad (4)$$

From the above formulae, the last address E(M) of the IC card memory is calculated as follows:

$$E(M) = \sum_{n=1}^{N} L(n) + 6M + 255 \qquad (5)$$

However, because of the limit on the IC card memory area the last address E(M) is as follows:

$E(M) \leq 8057$ (6)

Because of the limit of available RAM buffer space, the product of record length and number of records in a zone may not exceed 2048.

$l(n) \times m(n) \leq 2048$ (800H) (7)

IC CARD OPERATION

Figure 9 is a flow diagram of the IC card operation. In accordance with this flow chart, the IC card first receives a command from the reader/writer at 801. The IC card then does a check at 803 to determine whether the command is supported by the card. If the command is not valid, an error code indicating such is produced at 804 and processing stops. However, if the command is valid, it is executed at 805, and the output as a result of command execution is provided at 806.

COMMAND DESCRIPTION

The IC card uses 15 commands which are classified into 8 different groups, namely, IC card hardware test, formatting, key write, zone read/write, records remaining to be written in a zone, record status management, and card program version information read. It should be understood that some commands require particular keys and parameters for their execution. The IC card commands in accordance with the present invention are listed in Table B herein.

RESULT OF EXECUTIONS BY THE IC CARD (RESPONSES)

The IC card informs the reader/writer of the result of the execution of a command. If the command includes a read command, the data obtained through execution of the read command are included in the response provided to the reader/writer. The response indicating command execution by the IC card can take the form of one or more return codes.

READER/WRITER COMPONENT

The reader/writer 14 which is connected to the host computer 16 via a RS-232C communication link 18 and which accepts one or two IC cards will now be described. Figure 10 is a block diagram of a reader/writer 14 showing two ports numbered 1 and 2 (914 and 915) for receiving the IC information cards described above. The respective reader/writer ports are connected to card interfaces (I/F) 902 and 901 which are in turn connected via a data/address bus 903 to other components in the reader/writer. Also connected to the card interfaces 902 and 901 are respective buzzers or sound transducers 904 and 905, each of which may produce a different frequency, e.g. 600 Hertz and 2400 Hertz. A RAM memory 906 of 8K bytes, ROM memories 907 and 907A having a total of 16K bytes, and a CPU 908 in the form of a Z80A microprocessor are also connected to the data/address bus 903. The RS-232C interface 909 is also connected to the data/address bus 903. The reader/writer 14 is provided with a power supply 910 which receives 90 to 130 volts AC through a noise filter 911 and which supplies DC voltages of 5 volts, +12 volts and -12 volts.

As part of the reader/writer ports 914 and 915, card transports are provided for transporting the cards into and out of the reader/writer ports. Such transports are commercially available from various manufacturers, such as the Toppan Moore Company, Ltd. of Tokyo, Japan. An electrical schematic diagram of the interface for such a card transport is shown in Figure 11. In the lower portion of the figure, the electrical connections provided to the terminals of the IC card are indicated.

When an IC card is inserted into one of the read/write ports, a solenoid is activated and the respective card is held in place within the reader/writer 14. At this time, the corresponding card insertion state LED 912 or 913 as shown in Figure 10 is illuminated. When transactions involving the card are completed, the inserted card can be removed by pressing the card eject button 916 or 917 for the port in which the card is inserted. However, if the card eject button is pressed during IC card operation, i.e., while IC card operation indicator LED 918 or 919 is lit, the card eject button will be inoperative. The card may also be ejected by a command issued by the host computer as will be described below. When the card is ejected, the card insertion state LED 912 or 913 is extinguished.

A more detailed schematic diagram of the reader/writer in accordance with the invention is shown in Figures 12 and 13. Figure 12 shows on the left the Z80A CPU unit 908 being connected on the upper left to a clock which drives one of its inputs. A reset circuit is also provided on the left of this figure, as well as connections to the power LED and the connection socket for the power supply. Shown on the upper right in Figure 12 are the ROMs 907 and 907A and the RAM 906, which are connected to the Z80A CPU 908 by an address bus in the upper part of the figure and a data bus in the central part of the figure. A baud rate selection dip switch arrangement is shown in the bottom center portion of the figure, which also provides square wave outputs to drive the respective buzzers. Also shown in the bottom portion of this figure is the RS-232C interface which is connected to the baud rate selection chip and to the cable connector to the RS-232C interface.

Referring to Figure 13, the card interface units 901 and 902 are shown respectively in the right and left hand portions of the figure. Each of the interface units is connected to the data bus in the upper portion of the figure, and are connected to the various solenoid coils in the respective transport units of the reader/writer ports 914 and 915 via connection strips CN2 and CN3, respectively. The buzzer 905 for the card I/F1 is connectable to terminals a and b in the bottom right portion of the figure, and the buzzer 904 for card I/F2 is connectable to terminals c and d in the bottom center of the figure.

The reader/writer memory map is illustrated in Figure 14. This memory map shows the BIOS program area resident in a portion of the 8K byte area of ROM1 907, and the buffer for the BIOS present in a portion of the 8K byte area of RAM 906.

IC CARD SECURITY SYSTEM SOFTWARE

Figure 15 shows the configuration of the software provided for the present IC card system in simple block form. As shown in this figure, the host computer 16 contains the host application program and the input/output (I/O) handler. The I/O handler of the host communicates with the reader/writer 14 through the BIOS program of the reader/writer. The reader/writer also has an application program. Communication with the IC card 10 is made through the BIOS program of the reader/writer as shown. The IC card 10 also has its own card program resident in its microprocessor memory.

The host application program is prepared according to the particular business requirements of the IC card system user. The I/O handler of the host provides the basic input/output routine for communication between the host computer and reader/writer. The BIOS program is the input/output handler for the IC card reader/writer and can perform input/output operations via the RS-232C link to the host computer, input/output operations to and from the IC cards, and other functions. Typical other functions include turning on and turning off of the internal buzzers 904 and 905 of the reader/writer, and checking whether a card is inserted or not inserted. The application program of the reader/writer is prepared according to the requirements of the system. The card program which is built into the CPU of the IC card during chip fabrication controls the configuration and access of the IC card and the card memory, as described above.

The reader/writer is designed to facilitate the host computer in accessing the data stored in the IC card in order to fully utilize the IC card functions. Commands issued by the host computer can be divided roughly into the following command types: reader/writer control commands, data record control commands, IC card issue commands (IC card format command), and security related commands. The reader/writer application program implements the reader/writer BIOS commands, which are listed in TABLE B herein. It should be understood that the host computer and the IC card reader/writer can be connected over a telecommunication link via a modem/acoustic coupler.

The reader/writer application program in the preferred embodiment incorporates a security plan which uses one of the two cards as the control card and the second as the application or user card. This approach increases the overall security of the system by avoiding the dissemination of knowledge of the keys required to access the various data zones of the IC card memory. For example, the O-key need not be known to any person, since it can be stored in the control card. Therefore, that key is not readily available to someone who wishes to make an unauthorized access attempt in the user card. Additionally, the two card approach eliminates the need for the entry of the access keys and other information by the system user.

The reader/writer application program illustrated in Figure 40, operates as follows: After initialization 4001, a unique field (serial number) is read from the control card and stored in the reader/writer for later comparisons, process 4003. Various keys may then be read from protected zones within the control card, e.g., O-key, PIN key and any additional user defined keys, using processes 4004 through 4014, and stored within the reader/writer for later use in accessing the application or user card. It is noted that these keys may also be loaded into the reader/writer memory from the host computer. The commands from the host computer specify what kind(s) of key(s) are required for the specific operation. The reader/writer application

program interprets the commands and by using the previously stored keys issues the BIOS commands necessary to accomplish the specified operation. The additional security features of the reader/writer application program come into play at this point. Prior to issuing a command to the user card which requires one or more keys, the reader/writer application program checks the control card serial number, at 4009 to make sure that the control card has not been changed. If it has been changed, the control card serial number and the applicable keys in the reader/writer are set to zero, and an error message is returned to the host computer. Under such conditions, the command to the user card is not carried out. The commands defined by the reader/writer application program are listed in Table E.

As shown in Figure 14, the user's program area occupies memory locations 1000H to 1FFFH, or from 1000H to 3FFFH if optional ROM2 is used. The memory location in the RAM area at addresses E000H to E0FFH, i.e., 256 bytes, is used as a data buffer and as a stack for the BIOS program, leaving the RAM area from E100H to FFFFH as user memory.

ISSUE SYSTEM COMPONENTS AND OPERATION

The IC cards can be formatted (initialized) and personalized in a number of ways. The terms "formatting" and "initialization" both refer to the writing of the O-key, the zone definition table and, optionally, the PIN key in the IC card memory. The term "personalization" refers to the writing of appropriate data records in the data zones of the IC card memory.

One aspect of the present invention is to format and personalize a large number of IC cards for a particular application on a mass production basis. To accomplish this, an arrangement as shown in Fig. 16 is used which comprises an initializer (I/Z) 50 used in conjunction with a host computer 16. The host computer in the preferred embodiment is an IBM-XT having a CRT, a keyboard, a printer, a 10 MB hard disk, and a one or more double floppy diskette drives. The initializer 50 and the host computer 16 are connected to each other by a RS-232C communications link.

In accordance with the personalization process, the respective data files to be loaded into the IC cards are stored on the hard disk or floppy diskette or some other mass storage medium and are accessed by way of a personal code for each personal data file stored in the mass storage medium. Each IC card to be personalized is provided with a magnetic stripe in accordance with the conventional format and is magnetically encoded with a personal code for addressing a corresponding personal data file in the mass storage medium. The magnetic encoding of the magnetic stripe is carried out using conventional techniques preferably on the second track of the stripe in accordance with the ABA standard or JIS type I, or the first track in accordance with JIS type II.

The initializer 50 has an input slot or an input hopper for accepting cards and a card handler for moving each card automatically through a magnetic stripe reader to electrical contacts in the initializer which make electrical contact to respective IC card contacts C1-C8. Each card is first initialized by writing the O-key, the zone definition table and, optionally, the PIN key in the card memory. Such initialization information and the P-key, which is required before the initialization information can be written into the card memory, have been previously entered into the initializer and are stored in the initializer memory. The initialization information and the P-key are advantageously entered into the initializer by means of a master card, as will be described in further detail herein below.

Following initialization, if the card in the initializer is to be personalized, the personal code on the magnetic stripe is read and transferred to the host computer. In response to receiving the personal code of the card, the computer addresses the corresponding personal data file in the mass storage medium and personalizes the card by writing the data in the file in previously defined zones of the IC card memory. The initialized and personalized cards are then ejected.

In order to operate such a system, master cards 52, one or more IC cards 10, and several data files must be prepared. There are four types of master cards 52, one for each operation of the initializer. All master cards are previously written with information necessary for the respective operation according to a predetermined format. The information written on the master cards includes a different identification code for each operation and a batch number which is necessary for issue control. Figure 17 is a memory map of a master card 52.

The different operations of the IC card initializer include formatting, (initialization), personalization, unlocking, and formatting (initialization) with personalization.

The files necessary for formatting and personalization include a Z.D.T. (zone definition table) data file and an index file. The Z.D.T. file is used for formatting or for formatting with personalization. If the Z.D.T. data is written in the master card, the Z.D.T. file need not be stored in the memory associated with the host computer.

The index file is used for personalization or for formatting with personalization. The file contains the record length, the field configuration, and field number of the personal data file, the field number being used for the search. Also used for personalization or for formatting with personalization is a zone and field correspondence file in which the correspondence between the zone numbers in the card memory and the fields of the personal data file are defined. Lastly, a personal data file is used for personalization or for formatting and personalization. This file is prepared by the user of the system and consists of fixed length records not including a header and contains a field for record search.

The host computer has a main program to carry out initialization (formatting), personalization, unlocking or both initialization (formatting) and personalization of an IC card. The Z.D.T. data file, the personal data files, the index file and the zone and field correspondence file must all be created before an IC card is initialized and personalized by the main program. The main program also needs a master card on which the required data is written in a certain format.

MAIN PROGRAM

Figure 18 is a flow chart showing the pre-operation portion of the main program. The program first asks the user whether the communication parameters of baud rate, parity, stop bit and byte length should be set to their default values of 9600, none, 2 and 8, respectively. If not, the user then is requested to input other values for these parameters. The pass word is then requested, and if the entered password is satisfactory, the date and time are displayed for verification by the user. If the date and time are not correct, the user should input "n" which causes the program to return the system to DOS to allow the correct date and time to be entered. Once this has been done and the program reinitiated, if needed, the system completes the pre-operation. Thereafter the screen displays five menu items of format, personalization, unlock, format with personalization, and end. The user selects which one of the five menu items he desires. The first four menu items are now described.

FORMATTING (INITIALIZATION)

Figure 19 shows the flow chart for the formatting program. When this menu item is selected, the master card is inserted by the user, and the PIN number for the master card is requested and entered by the user. If the inserted master card contains the ZDT data and the O-key (or a corresponding key for a different embodiment) such data and key are automatically read, and the master card is ejected. The program then asks the user to enter the number of cards which are to be formatted. If the inserted master card does not contain the ZDT data, the system reads the ZDT data file from the memory associated with the host computer. The file contents are then displayed and checked by the user. If the inserted master card does not contain the O-key data, this data is entered from the keyboard by the user. The master card processing is then complete, and the IC cards to be formatted are then inserted into the initializer. Each time a card is formatted, the user is asked whether or not the formatting should continue for the remaining cards or whether the formatting should be terminated. When the desired number of cards have been formatted, the main program returns to the menu.

PERSONALIZATION

Figure 20 shows the flow diagram for the personalization program. In accordance with this program, master card insertion is requested, and if the inserted master card is found to be correct, the entry of the PIN number for the master card is requested from the user. If the master card contains the O-key, the system automatically reads the key, and the master card is ejected. However, if the master card does not contain the O-key data, the user must enter this data via the keyboard. The system then reads the three files necessary for personalization, namely: the index file; the personal data file; and the zone and field correspondence file. After the system has read the contents of all the necessary files, it requests the insertion of cards to personalize. The cards inserted into the initializer at this point must have been previously formatted and have the appropriate magnetic data encoded on their magnetic stripes in order to allow the host computer to find the proper personal data file in the mass storage medium.

The IC cards are then fed, one at a time, into the initializer. The initializer reads the magnetic stripe on each card to find the personal code and obtains the personal data file corresponding to that personal code from the mass storage medium and writes the personal data from the file into the IC card memory. At this time the PIN key may also be written into the IC card. The PIN number may also be written into the IC card at a later time by the system user. After each card is personalized, the system requests whether further

personalization of the remaining cards should continue. Once all of the cards have been personalized or upon early termination of the personalization process, the main program returns to the menu.

UNLOCK PROCESS

Figure 21 shows the flow chart procedure for the unlock process. According to this process, the program asks the user to insert the master card and to input the PIN key for the master card. The O-key is then entered by the user from the keyboard of the host computer if the inserted master card does not contain this key. The master card is then removed and the IC cards to be unlocked are then inserted. The individual PIN keys associated with each card are then entered, and the system checks to see whether these PIN numbers are correct. After each card is unlocked (or if unlock is refused because of an improper PIN number), the card is ejected and the user has the option of continuing with further unlocking of the other cards or returning to the menu.

FORMATING AND PERSONALIZATION IN COMBINATION

Figure 22 shows the flow chart for the formatting (initialization) with personalization in combination. This flow chart is essentially a combination of the individual steps from the formatting and personalization flow charts of Figures 19 and 20.

OUTPUT FILE

An output file called XREPORT (wherein X may be replaced by F, P, U or C depending upon the type of operation carried out by the initializer, i.e., formatting, personalization, unlocking or formatting and personalization combined) is prepared during initializer operation. All errors made during the operation are recorded in a file called XERROR, wherein X may be replaced by F, P, U or C. All file contents can be checked using conventional file handling means.

INITIALIZER COMMUNICATIONS SPECIFICATION

All communications between the host computer and the initializer are carried in string format comprising two bytes indicating string length, one byte indicating the type of string, bytes of data and one final byte indicating the checksum. The string length is a two byte field indicating the length of the entire string excluding the checksum byte at the end of the string. (The order of the field is the least significant byte first and the most significant byte last.) There are four types of strings, namely, a command string (designated by 01), a data string (02) and information string (03) and a control string (04). The data can be any number of bytes needed corresponding to a string type. The checksum is the sum of all string data just before the checksum and is provided in two's complement format.

The command string format is essentially the same general format as indicated above, except that the data comprises a command code and parameters. The format for the data string is also essentially the same as described above, except that the data includes a field indicating the number of data elements and another field indicating the data length in bytes. The format for the information string is essentially the same as that described above, except that the string length is fixed at 5, and the data includes error type and error detail examples. The format for the control string is also generally the same as that described above, except that the string length is fixed at 4 and the control code is one of three types, namely, 01H indicating ACK, 02H indicating NAK, 03H indicating EOT.

PROGRAM LISTING AND COMMAND CODES

A print listing for the reader/writer basic input/output system (BIOS) in accordance with the invention is included in Appendix I. A listing of the BIOS commands is provided in Table C herein. Table D herein lists these commands and shows the information transferred between the reader/writer and IC card during command execution, as well as the string format.

Figures 23 through 39 illustrate the command protocols between the reader/writer and IC card, showing the direction and sequence of command, parameters, return and error codes between the reader/writer and IC card. The commands illustrated in these figures correspond generally to many of the BIOS commands listed on Table C herein.

A print listing of the reader/writer application program, in accordance with the present invention, is also included in Appendix I. The commands used in the reader/writer application program are shown in Table E herein, which also illustrates the protocol used with the commands.

Figures 41 through 91B are flow charts of the IC card program, in accordance with the present invention. A print listing of the IC card program, in accordance with the invention, is included in Appendix I.

Figures 92 through 108B illustrate the command protocol between the host computer and initializer (I/Z) during the initialization process.

While a particular embodiment of an IC card security system has been shown and described, numerous variations and modifications will readily occur to those skilled in the art. The invention is not intended to be limited to the embodiment illustrated and described but is merely illustrative of the application of the principles of the invention, whose scope is pointed out in the appended claims.

TABLE B

COMMAND CODE (hex)	NEMONIC	FUNCTION
21H	PINWR	PIN Code WRITE
23H	OKEYWR	Organization KEY WRITE
25H	WRZDT	WRiTE Zone Definition Table
26H	CLZDA	CLOSE Zone Definition Table Area
24H	RDZDT	READ Zone Definition Table
10H	RDZONE	READ RECORDS In a Zone
11H	WRZN	WRITE RECORD onto a Zone
13H	WRZNWV	WRITE RECORD onto a Zone with Verify
15H	STWR	Record Status Byte Mark
14H	STRD	Record Status Byte Read a Zone
27H	UNLOCK	UNLOCK the locked Card
28H	REMAIN	READ Number of Remaining Records
30H	MTEST	CARD TEST AT MANUFACTURING
31H	RTEST	CARD READ TEST
42H	RDMPD	READ MASK PROGRAM DATA (NAME)

TABLE C

BIOS COMMAND LIST (BIHWT11C)		
COMMAND CODE (hex)	NEMONIC	FUNCTION
01H	SELCR1	Select Card reader #1
02H	SELCR2	Select Card reader #2
03H	BZON	Buzzer on
04H	BZOFF	Buzzer off
05H	SDIN	RS-232C Data input
06H	SDOUT	RS-232C Data output
07H	CDINCK	Card in check
08H	INIT	Initialize IC card reader/writer
09H	CEJCT	Card eject
10H	RDZN	Read a zone
11H	WRZN	Write a zone
13H	WRZNWV	Write a zone with verify
14H	STRD	Read record status byte
15H	STWR	Write record status byte
21H	PINWR	Write Pin code
23H	OKEYWR	Organization key write
24H	RDZDT	Read Zone Definition Table
25H	WRZDT	Write Zone Definition Table
26H	CLZDA	Close Zone Definition Table Area
27H	UNLOCK	security lock cancel
28H	REMAIN	read remaining number of records
30H	MTEST	Card test at manufacturing
31H	RTEST	Card read test (test at using)
42H	RDMPD	Read mask program data
note: command code and another parameter should be set to A-register and proper registers before BIOS call.		

TABLE D

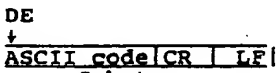
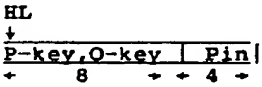
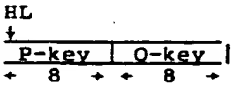
COMMAND	INPUT	RETURN	
SELCR1 (01H)	nothing	nothing	
SELCR2 (02H)	nothing	nothing	
CDINCK (07H)	nothing	A:return code	
BZON (03H)	nothing	A:return code	
BZOFF (04H)	nothing	A:return code	
INIT (08H)	nothing	A:return code	Select reader #1. Only one time usable at power on.
CEJCT (09H)	nothing	A:return code	
SDIN (05H)	<DE:buffer address>	A:return code C:number of input bytes (including CR,LF code)	
SDOUT (06H)	DE:buffer address of output data	A:return code	
PINWR (21H)	HL:buffer address	A:return code	
OKEYWR (23H)	HL:buffer address	A:return code	

TABLE D (Cont'd)

COMMAND	INPUT	RETURN	
WRZDT (25H)	HL:buffer address B:zone number(01H~FFH)	A:return code	HL → | P-key (8) | ZDT data (6) |
CLZDA (26H)	HL:buffer address	A:return code	HL → | P-key (8) |
RDZDT (24H) Needs one of 3 keys	B:zone number(01H~FFH) C:key type (1:Pin,2:0-key,5:P-key) HL:buffer address <IX:buffer address for read data>	A:return code IX:buffer address of read data	INPUT HL → | KEY (4or8) | RETURN IX → | ZDT (6) |
RDZN (10H)	B:zone number(01H~FFH) C:key type bit0~3:1st key type bit4~7:2nd key type (C reg: | 7-2nd-4 | 3-1st-0 |) type:1H Pin type 2H 0-key,5H P-KEY FH No key HL:buffer address HL→ | 1st key | | 2nd key | <IX:buffer address for read data>	A:return code D:Number of records[N] E:record length[L] IX:read data buffer address	IX→ | No.1 record | check byte | No.2 record | check byte | … | No.[N] record | check byte | (each record: L)
WRZN (11H)	B,C,HL: Same as RDZN command E:data length(L bytes) IY:buffer address of Write data	A:return code	IY→ | Data to be written | (L)

2nd key type and 2nd key are not always necessary.
(and for lowest security level the 1st key is not needed either).

TABLE D (Cont'd)

COMMAND	INPUT	RETURN	
WRZNWV (13H)	B,C,HL,E,IY: Same as WRZN command	A:return code	
STWR (15H)	B,C,HL: Same as RDZN command D:record No. (01H~FFH) E:bit No. (0-7)	A:return code	
STRD (14H)	B,C,HL: Same as RDZN command <IX:buffer address for status bytes>	A:return code D:number of records(N) IX:buffer address of status bytes	IX→ status bytes ↑ N ↓
UNLOCK (27H) Needs 2 of 3 keys	C:1st and 2nd key type 1H:Pin 2H:0-key 5H:P-key (C reg: 7-2nd-4 3-1st-0) HL:buffer address of key	A:return code	HL→ 1st key 2nd key
REMAIN (28H)	B,C,HL: Same as RDZN command	A:return code D:number of records remaining a zone	
MTEST (30H)	nothing	A:return code(result)	Mfr. use

1st step : card memory blank check, 2nd step : test write and verify
Test write means to write test data on test address (see below table)
After MTEST command, card memory is like following:

Addr.(hex)	0	1	2	4	8	10	20	40	80	100	200	400	800	1000
Data.(hex)	00	22	22	33	44	55	66	77	88	99	AA	BB	CC	DD

COMMAND	INPUT	RETURN	
RTEST (31H)	nothing	A:return code(result)	Check test datas on test address

TABLE D (Cont'd)

COMMAND	INPUT	RETURN	
RDMPD (42H)	<IX:buffer address for mask program data>	A:return code	IX→ mask program data

TABLE E

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
Read # Transactions left in Zone to write			Key must be previously set for the card being accessed.
RM RMP RMO RMB	Command Zone #	Return Code # Records left	
RME	Command Key Type Key Zone #	Return Code # Records left	Key is not preset.
Read Zone			Key must be previously set for the card being accessed.
RN RP RO RB	Command Zone #	Return Code # of Records Record length Record #1 to Record #n	
RE	Command Key Type Key Zone #	Return Code # Records used Record length Record #1 to Record #n	Key is not preset.

TABLE E (Con't)

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
Write Zone			Key must be previously set for the card being accessed.
WN	Command		
WP	Zone #		
WO	Data		
WB		Return Code	
WE	Command Key Type Key Zone # Data		Key is not preset.
		Return Code	
Write Zone w/Verify			Key must be previously set for the card being accessed.
VN	Command		
VP	Zone #		
VO	Data		
VB		Return Code	
VE	Command Key Type Key Zone # Data		Key is not preset.
		Return Code	

TABLE E (Con't)

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
Read Zone Definition			Key must be previously set for the card being accessed.
ZN	Command		
ZP	Zone #		
ZO		Return Code	
ZB		Zone Definition Bytes	
ZE	Command Key Type Key Zone #		Key is not preset.
		Return Code Zone Definition Bytes	
Card in Check			R/W returns Error Code if Card not in
CD	Command		
		Return Code	
Select Card Module			NO return code
C1 C2	Command		

TABLE E (Con't)

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
Card Eject			Eject Card from selected module
CE	Command	Return Code	
Card Application Check			Application Type is in Zone 1 - No security
CA	Command	Return Code Application Info	
Get Key from Host			Gets the key and stores it for later use - for the logged card
GP GO	Command Key	Return Code	
Get Key from Control Card			Gets the key and stores it for later use - for card one only
GCP GCO GC1 GC2 GC3 GC4 GC5	Command	Return Code	Pin for control card must be previously set (from host)

TABLE E (Con't)

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
Test the Card			Simple read test routine
TR	Command	Return Code	
Status Byte Read			Key must be previously set for the card being accessed.
SR	Command		
SRP	Zone #		
SRO		Return Code	
SRB		# of Records Stat byte #1 to Stat byte #n	
SRE	Command Key Type Key Zone #		Key is not preset.
		Return Code # Records used Stat byte #1 to Stat byte #n	
Status Byte Write			Key must be previously set for the card being accessed.
SWN	Command		
SWP	Zone #		
SWO	Record #		
SWB	Bit # (0-7)		
		Return Code	

TABLE E (Con't)

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
SWE	Command Key Type Key Zone # Record # Bit # (0-7)	Return Code	Key is not preset
Report Version R/W			Returns the version of the EPROM in the R/W
VRS	Command	Version Info	
Unlock Locked Card			Unlocks card that has been locked by security
UN	Command	Return Code	PIN and O-Key must be preset before use
Buzzer Control			Turns buzzer on (BN) or off (BF) for logged Card Module
BN BF	Command	Return Code	
Report Version Card			Returns the version of the program in the Card
DR	Command	Return Code Version Info	

TABLE E (Con't)

Reader/Writer Application Program Commands

COMMAND	INPUT	OUTPUT	COMMENTS
Write PIN in Card			Writes the PIN into the card for security use
KP	Command O-Key PIN (to be written)	Return Code	

GENERAL INFORMATION:

All commands, and parameters sent to the card, if any for the particular command, are terminated by an ASCII Carriage Return - Line Feed pair of characters. Additionally, all data transmissions from the Reader/Writer are also terminated by an ASCII Carriage Return - Line Feed pair of characters.

All commands which require a key to operate (unless there is a choice of keys available) require that the key be previously set for the R/W - either from the host or from the control card. The E (Either) option requires the key type and key be entered from the host program.

TABLE F

Command codes are:	
00H:	NOP
01H:	Card in
02H:	Card out
03H:	Write magnetic data
04H:	Read magnetic data
05H:	Contactor down
06H:	Contactor up
07H:	Write a zone
08H:	Read a zone with data
09H:	Read a zone without data
0AH:	Formatting
0BH:	Unlock
0CH:	Check sensor
0DH:	On each output device
0EH:	Off each output device
0FH:	Transmit data
10H:	Write PIN

Claims

1. An IC information card (10) comprising:
input/output means (24) in the card for receiving at least data, commands and keycodes and for

providing at least data;

nonvolatile read/write memory means (22) within the card (10), the memory means having a multiplicity of addressable bit storage locations;

first means (20) within the card responsive to a first command, zone definition data and an entered keycode received by the input/output means (24) for comparing the entered keycode with a first keycode stored in the card and for writing the zone definition data in a first region of the memory means (22) only if the received keycode matches the first keycode, the zone definition data comprising one or more zone definition words (701, ..., 704) each corresponding to a respective data zone (707) in a second region of the memory means, each zone definition word specifying at least the starting address of the corresponding data zone and the size of the corresponding data zone.

2. An IC information card (10) according to claim 1, wherein the card further comprises second means (20) within the card responsive to a second command, keycode data comprising one or more additional keycodes and an entered keycode received by the input/output means (24) for comparing the entered keycode with the first keycode and for writing the keycode data in a third region of the memory means only if the entered keycode matches the first keycode, and wherein each zone definition word further specifies either no keycode or one or more of the first keycode and the additional keycode or keycodes as being required to be received by the input/output means (24) in order to read data from the corresponding zone and either no keycode or one or more of the first keycode and the additional keycode or keycodes as being required to be received by the input/output means (24) in order to write data in the corresponding data zone.

3. An IC information card (10) according to claim 2, wherein the card further comprises third means (20) within the card responsive to the input/output means (24) receiving a read command, a code specifying a particular one of the data zones (707) from which data is to be read and any entered keycode or keycodes, for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to read data in the particular data zone (707) and for providing data from the particular zone to the input/output means (24) if the entered keycode or keycodes match the keycode or keycodes specified as being required to read data from the particular data zone (707) or if no keycode is specified as being required to read data from the particular data zone (707), and wherein the card further comprises fourth means (20) within the card responsive to the input/output means (24) receiving a write command, a code specifying a selected one of the data zones (707) in which data is to be written, data to be written in the selected zone and any entered keycode or keycodes, for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to write data in the selected data zone (707) and for writing the received data in the selected data zone (707) if the entered keycode or keycodes match the keycode or keycodes specified as being required to write data in the selected data zone (707) or if no keycode is specified as being required to write data in the selected data zone (707).

4. An IC information card (10) according to claim 3, wherein data is stored in each data zone (707) as successively located data records (722, ..., 727) and each zone definition word (701, ..., 704) further specifies the maximum number of data records that can be stored in the corresponding zone, the length of the data in each data record in the corresponding zone and a zone allocation area (721) in the memory means (22) for storing data indicative of the location of the next data record to be stored in the corresponding zone (707).

5. An IC information card (10) according to claim 4, wherein the zone allocation area (721) is located in the corresponding zone (707) and contains one or more successively ordered bit positions each associated with a respective data record position in the zone each bit position of the zone allocation area (721) containing a first or a second binary state depending upon whether or not the data record position associated with that bit position contains a data record, respectively, and wherein the fourth means (20) is further responsive to the contents of the zone allocation area (721) of the selected zone (707) for writing a data record (722, ..., 727) in the selected zone in the data record position therein that is associated with the lowest order bit position of the zone allocation area (721) therein containing the second binary state and for writing a first binary state in that lowest order bit position containing the second binary state.

6. An IC information card (10) according to claim 4, wherein each data record (722, ..., 727) stored in a data zone (707) includes a checksum byte and a second status byte indicative of the validity of the data in the data record (722, ..., 727).

7. An IC information card (10) according to claim 4, wherein each zone definition word (701, ..., 704) further specifies whether the data provided to the input/output means (24) by the third means (20) in response to a read command and a code specifying data to be read from the corresponding zone (707) is only the last data record to be written in the corresponding zone (707) or all data records (722, ..., 727) that are stored in the corresponding zone (707) in the order in which such data records (722, ..., 727) are written in the corresponding zone (707).

8. An IC information card (10) according to claim 3, wherein the third region of the memory means (22) further contains a plurality of successively ordered lock status words, including a first and a last lock status word, each lock status word having a predetermined number of successively ordered bit positions, including a first and a last bit position, each bit position of each lock status word being initially in a second binary state, and wherein the card further comprises fifth means (20) within the card responsive to a failure of an entered keycode to match a keycode stored in the card, as a result of a keycode comparison made by the first (20), second (20), third (20) or fourth means (20) for writing a first binary state in the lowest order bit position that is in the second binary state of the lowest order lock status word in which the highest order bit position is in the second binary state, the fifth means (20) being responsive to a match of an entered keycode with a keycode stored in the card occurring directly after a failure of an entered keycode to match a keycode stored in the card, as a result of a comparison made by the first (20), second (20), third (20) or fourth means (20), for writing a first binary state in the highest order bit position of the lock status word in which a first binary state was written by the fifth means (20) in response to the directly preceding failure of an entered keycode to match a keycode stored in the card (10), and wherein the card (10) further comprises sixth means (20) within the card responsive to a lock status word having all but its highest order bit position in the first binary state for placing the card in a locked state in which at least reading and writing access to the first and second regions of the memory means (22) are prevented, and seventh means (20) within the card responsive to an unlock command and one or more entered key-codes for comparing the entered keycode or keycodes with preselected keycode or keycodes stored in the card (10) and for writing a first binary state in the highest order bit position of the lock status word having all but the highest order bit position in the first binary state to release the card from the locked state, if the entered keycode or keycodes match the preselected keycode or keycodes.

9. An IC information card (10) according to claim 8, wherein the first (20), second (20), third (20), fourth (20), fifth (20), sixth (20) and seventh means (20) are included in an appropriately programmed microprocessor (20) operatively coupled to the input/output means (24) and the memory means (22) includes a programmable read-only memory operatively coupled to the microprocessor.

10. An IC information card system comprising:

a first (52) and second IC (10) information card each having:

(a) input/output means (24) in the card for receiving at least data, commands and keycodes and for providing at least data,

(b) means storing a first keycode,

(c) nonvolatile memory means (22) within the card (10) having a first region for storing one or more keycodes and a second region segmented into a plurality of data zones (701, ..., 704), each one of the data zones (707) being defined to require either no keycode or a specified one or more of the first keycode and the keycode or keycodes stored in the first region to be entered into the card in order to read data in that data zone (707) and to require either no keycode or a specified one or more of the first keycode and the keycode or keycodes stored in the first region to be entered into the card in order to write data in that data zone (707),

(d) first means (20) within the card responsive to the input/output means (24) receiving a read command, a code specifying a particular one of the data zones (707) in which data is to be read and any entered keycode or keycodes, for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to read data in the particular data zone (707) and for providing data from the particular zone (707) to the input/output means (24) if the entered keycode or keycodes match the keycode or keycodes specified as being required to read data in

the particular data zone (707) or if no keycode is specified as being required to read data from the particular data zone, and

(e) second means (20) within the card responsive to the input/output means (24) receiving a write command, a code specifying a selected one of the data zones (707) in which data is to be written, data to be written into the selected zone (707) and any entered keycode or keycodes, for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to write data in the selected data zone (707) and for writing the received data in the selected zone (707) if the entered keycode or keycodes match the keycode or keycodes specified as being required to write data in the selected data zone (707) or if no keycode is specified as being required to write data in the selected zone (707), wherein the memory means of the first card (52) includes one or more data zones (707) each storing a respective one or a combination of the first keycode and the keycode or keycodes stored in the first region of the memory means (22) of the second card (10); and

IC card reader/writer means (14) having:

(a) a first (914) and a second port (915) for receiving the first (52) and second (10) cards, respectively, and for coupling to the input/output means (24) thereof,

(b) coupling means for receiving at least commands, data and keycodes and for providing at least data (909),

(c) reader/writer memory means (906),

(d) first means 908 responsive to the coupling means 909 receiving a command to read the second card (10) a code specifying a particular zone (707) in the second card (10) in which data is to be read and any keycode or keycodes to be entered in the first card (52), for providing to the input/output means 24 of the first card (52) one or more read commands together with a code or codes specifying the data zone or zones (707) of the memory means (22) of the first card (52) where the keycode or keycodes required to read data in the particular zone (707) of the second card (10) are stored and any keycode or keycodes received by the coupling means (909) for transferring such required keycode or keycodes to the reader/writer memory means (906) if the keycode or keycodes received by the coupling means (909) match the respective keycode or keycodes that are required to read the one or more data zones 707 of the memory means (22) of the first card (52) or if no keycodes are required to read such data zones (707), for providing to the input/output means (24) of the second card (10) the read command, a code specifying the particular data zone (707) and the keycode or keycodes for reading data in the particular zone (707) transferred from the memory means (22) of the first card (52) to the reader/writer memory means (906), and for transferring any data provided by the input/output means (24) of the second card (10) to the reader/writer memory means (906), and

(e) second means 908 responsive to the coupling means (909) receiving a command to write to the second card (10), a code specifying a selected zone (707) in the second card (10) in which data is to be written, data to be written in the selected zone (707) and any keycode or keycodes to be entered in the first card (52) for providing to the input/output means (24) of the first card (52) one or more read commands together with a code or codes specifying the data zone or zones (707) of the memory means (22) of the first card (52) where the keycode or keycodes required to write data in the selected zone (707) of the second card (10) are stored and any keycode or keycodes received by the coupling means (909), for transferring such required keycode or keycodes to the reader/writer memory means (906) if the keycode or keycodes received by the coupling means (909) match the respective keycode or keycodes that are required to read the one or more data zones (707) of the memory means (22) of the first card (52) or if no keycodes are required to read such data zones (707), and for providing to the input/output means (24) of the second card (10) the write command, a code specifying the selected zone (707), the data to be written in the selected zone (707) and the keycode or keycodes required for writing data in the selected zone (707) transferred from the memory means (22) of the first card (52) to the reader/writer memory (906).

11. IC information card system according to claim 10, wherein the memory means (22) of the first card (52) includes a first data zone (705) containing an identification code for the card (10) and wherein the reader/writer means (14) further comprises third means (908) for reading the first zone (705) of the memory means (22) of the first card (52) following initial coupling of the first card (52) to the reader/writer means (14) and transferring the identification code therein to the reader/writer memory means 906 and for reading the first zone (705) of the memory means (22) of the first card (52) each

time the coupling means (909) receives a command to read the second card (10) or command to write to the second card (10) and comparing the contents read therein with the identification code stored in the reader/writer memory means (906), the third means (908) preventing at least reading and writing of the memory means (22) of the second card (10) if the contents of the first data zone (705) of the memory means (22) of the first card (52) fails to match the identification code stored in the reader/writer memory means (906).

12. An initialization system (50) for IC information cards each including first means (20) within the card responsive to a first command, zone definition data and an entered keycode received by the input/output means (24) for comparing the entered keycode with a first keycode stored in the card for writing the zone definition data in a first region of the memory means (22) only if the received keycode matches the first keycode, the zone definition data comprising one or more zone definition words (701, ..., 704) each corresponding to a respective data zone (707) in a second region of the memory means, each zone definition word (701, ..., 704) specifying at least the starting address of the corresponding data zone (707) and the size of the corresponding data zone (707), and second means (20) within the card responsive to a second command, keycode data comprising one or more additional keycodes and an entered keycode received by the input/output means (24) for comparing the entered keycode with the first keycode and for writing the keycode data in a third region of the memory means only if the entered keycode matches the first keycode, and wherein each zone definition word (701, ..., 704) further specifies that either no keycode or one or more of the first keycode and the additional keycode or keycodes are required to be received by the input/output means (24) in order to read data from the corresponding zone (707) and either no keycode or one or more of the first keycode and the additional keycode or keycodes are required to be received by the input/output means (24) in order to write data in the corresponding data zone (707), the system comprising:

input means for receiving one of the cards at a time to be initialised and for coupling to the input/output means (24) of the card received thereby;

initializer memory means for storing the first keycode, appropriate zone definition data and additional keycode or keycodes;

first initializer means for writing the zone definition data stored in the initializer memory means to the first region of the memory means of the card received by the input means using the first command, and the first keycode stored in the initializer memory means; and

second initializer means for writing the additional keycode or keycodes stored in the initializer memory to the third region of the memory means of the card received by the input means using the second command, and the first keycode stored in the initializer memory means.

13. An IC information card initializer system (50) according to claim 12, wherein the first keycode, the zone definition data and the additional keycodes are stored in a master card (52) which is received by the input means before receiving the first one of the cards to be initialized and the system further comprises third initializer means for transferring the first keycode, the zone definition data and the additional keycode or keycodes from the master card to the initializer memory means.

14. An IC information card initialization system (50) according to claim 12, wherein the system further comprises automatic feeder means for receiving a multiplicity of the cards to be initialized and for feeding the cards one at a time to the input means and automatic receiving means for receiving a card after the zone definition data and the additional keycode or keycodes have been written into the memory means thereof.

15. An IC information card initialization system (50) according to claim 12, wherein the card further includes third means (20) within the card responsive to a write command, a code specifying a selected one of the data zones in which data is to be written, data to be written in the selected zone and any entered keycode or keycodes received by the input/output means (24) for comparing any entered keycode or keycodes with any keycode or keycodes specified as being required to write data in the selected data zone (707) and for writing the received data in the selected data zone (707) if the entered keycode or keycodes match the keycode or keycodes specified as being required to write data in the selected data zone or if no keycode is specified as being required to write data in the selected data zone (707), and second memory means (19) for storing a file identification code, and wherein the system further comprises:

means for reading the second memory means (19) for obtaining the file identification code of a

card received by the input means;

mass storage means (16) for storing a multiplicity of data files each associated with a respective file identification number, each data file having a plurality of data segments corresponding to respective data zones (707) of a card (10) as defined by the zone definition data (701, ..., 704) written into the card 10 by the first initializer means;

third initializer means responsive to the file identification code obtained by the means for reading the second memory means (19) for searching the data files in the mass storage means (16) for the data file associated with that file identification code; and

fourth initializer means for writing the segments of the associated data file into corresponding data zones (707) of memory means (22) of the card (10) received by the input means using the write command and appropriate keycode or keycodes, if any, required for writing data in each corresponding data zone (707).

16. An IC information card initialization system (50) according to claim 15 wherein the second memory means (19) of the card (10) is a magnetic stripe on the card and the means for reading the second memory means is a magnetic stripe reader.

17. In an IC information card 10 containing a non-volatile memory means 22 having a multiplicity of addressable bit storage locations, a method for segmenting a data storage region of the memory means 22 into a plurality of data zones (707) each having assignable attributes including an assignable security access level, the method comprising the steps of:

defining first, second and third regions in the memory means (22), the third region being the data storage region;

requiring the entry in the card (10) of at least a first keycode for writing in the first and second regions of the memory means (22);

writing one or more keycodes in the first region of the memory means by entering the first keycode and any additional required keycodes; and

writing zone definition data in the second region of the memory means (22) by entering the first keycode and any additional keycodes, the zone definition data comprising one or more zone definition words (701, ..., 704) each corresponding to a respective data zone (707) in the third region of the memory means (22), each zone definition word specifying at least the starting address of the corresponding zone (707), the size of the corresponding zone (707) and whether no keycode or one or more of the first keycode and the keycode or keycodes in the first region are required to be entered in the card (10) to read data in the corresponding data zone (707) and whether no keycode or one or more of the first keycode and the keycode or keycodes in the first region are required to be entered in the card (10) to write data in the corresponding zone (707).

18. The method according to claim 17 wherein data is stored in each data zone (707) as successively located data records (722, ..., 727) and each zone definition word (701, ..., 704) further specifies the maximum number of data records that can be stored in the corresponding zone (707), the length of the data in each data record (722, ..., 727) in the corresponding zone (707) and a zone allocation area (721) in the memory means (22) for storing data indicative of the location of the next data record (722, ..., 727) to be stored in the corresponding zone (707).

19. In an IC information card (10) containing a non-volatile memory means (22) having one or more data zones (707) each requiring the entry in card (10) of a respective keycode or combination of keycodes for reading data in the data zone (707) and a respective keycode or combination of keycodes for writing data in the data zone (707), a method for preventing the dissemination of knowledge of the respective keycode or keycodes required for reading or writing in the data zones (707) of the card (10) comprising the steps of:

storing the respective keycode or keycodes required for reading or writing in the data zones (707) of the memory means (22) of the card (10) in a separate control card (52); and

transferring by two card reader/writer means (14) any required keycode or keycodes from the control card (52) to the card (10) when reading or writing of a selected one of the data zones (707) in the memory means (22) of the card (10) is to be carried out.

Patentansprüche

1. IC-Informations-Karte mit:
einer Eingabe/Ausgabe-Einrichtung (24) in der Karte, um Wenigstens Daten, Befehle und Tastenschlüssel zu empfangen und um wenigstens Daten bereitzustellen;
einer nicht-flüchtigen Lese/Schreib-Speicher-Einrichtung (22) in der Karte (10), wobei die Speichereinrichtung eine Vielzahl von adressierbaren Bit-Speicherstellen hat;
einer ersten Einrichtung (20) in der Karte, die auf einen ersten Befehl, Zonendefinitionsdaten und einen von der Eingabe/Ausgabe-Einrichtung (24) eingegebenen Tastenschlüssel reagiert, um den eingegebenen Tastenschlüssel mit einem erst in der Karte gespeicherten Tastenschlüssel zu vergleichen, und zum Schreiben der Zonendefinitionsdaten in einen ersten Bereich der Speichereinrichtung (22), falls der empfangene Tastenschlüssel mit dem ersten Tastenschlüssel übereinstimmt, wobei die Zonendefinitionsdaten ein oder mehrere Zonendefinitionsworte (701, ... , 704) aufweisen, wobei jedes einer jeweiligen Datenzone (707) in einem zweiten Bereich der Speichereinrichtung entspricht, und jedes Zonendefinitionswort wenigstens die Anfangsadresse der zugehörigen Datenzone und der Größe der zugehörigen Datenzone spezifiziert.

2. IC-Informations-Karte (10) nach Anspruch 1,
bei der die Karte desweiteren eine zweite Einrichtung (20) in der Karte aufweist, die auf einen zweiten Befehl, Tastenschlüsseldaten, die wenigstens ein oder mehrere Tastenschlüssel aufweisen und einen durch die Eingabe/Ausgabe-Einrichtung (24) empfangenen eingegebenen Tastenschlüssel reagiert, um den eingegebenen Tastenschlüssel mit dem ersten Tastenschlüssel zu vergleichen, und zum Schreiben der Tastenschlüsseldaten in einen dritten Bereich der Speichereinrichtung, falls der eingegebene Tastenschlüssel mit dem ersten Tastenschlüssel übereinstimmt, und wobei jedes Zonendefinitionswort desweiteren entweder keinen Tastenschlüssel oder einen oder mehrere des ersten Tastenschlüssels und den oder die zusätzlichen Tastenschlüssel als zum Empfang durch die Eingabe/Ausgabe-Einrichtung (24) erforderlich spezifiziert, um Daten von der jeweiligen Zone zu lesen und entweder kein Tastenschlüssel oder einer oder mehrere der ersten Tastenschlüssel und der oder die zusätzlichen Tastenschlüssel als zum Empfangen durch die Eingabe/Ausgabe-Einrichtung (24) als erforderlich spezifiziert, um Daten in die zugehörige Datenzone zu schreiben.

3. IC-Informations-Karte (10) nach Anspruch 2,
bei der die Karte desweiteren eine dritte Einrichtung (20) in der Karte aufweist, die von der Eingabe/Ausgabe-Einrichtung (24) einen Lesebefehl, einen eine bestimmte der Datenzonen, (707) von der Daten zu lesen sind, spezifizierenden Code und jeglichen eingegebenen Tastenschlüssel oder eingegebenen Tastenschlüssel empfangen, um jeglichen eingegebenen Tastenschlüssel oder eingegebene Tastenschlüssel mit einem Tastenschlüssel oder Tastenschlüsseln zu vergleichen, die als erforderlich spezifiziert sind, um dann in der bestimmten Datenzone (707) zu lesen und zum Bereitstellen von Daten von der bestimmten Zone an der Eingabe/Ausgabe-Einrichtung (24) falls der eingegebene Tastenschlüssel oder die eingegebenen Tastenschlüssel mit dem Tastenschlüssel oder den Tastenschlüsseln übereinstimmen, die als erforderlich spezifiziert worden sind, um Daten von der bestimmten Datenzone (707) zu lesen, oder falls kein Tastenschlüssel als erforderlich spezifiziert worden ist, um Daten von der bestimmten Datenzone (707) zu lesen, und wobei die Karte desweiteren eine vierte Einrichtung (20) in der Karte aufweist, die auf einen Schreibbefehl, einen eine bestimmte der Datenzonen (707), in die Daten einzuschreiben sind, spezifizierenden Code, in die ausgewählte Zone einzuschreibende Daten und jeglichen Tastenschlüssel oder Tastenschlüssel reagiert, um jeglichen eingegebenen Tastenschlüssel oder Tastenschlüssel mit einem Tastenschlüssel oder Tastenschlüsseln zu vergleichen, die als erforderlich spezifiziert worden sind, um Daten in die ausgewählte Datenzone (707) zu schreiben und zum Schreiben der empfangenen Daten in die ausgewählte Datenzone (707), falls der eingegebene Tastenschlüssel oder die Tastenschlüssel mit dem Tastenschlüssel oder den Tastenschlüsseln übereinstimmen, die als erforderlich spezifiziert worden sind, um dann in die ausgewählte Datenzone (707) zu schreiben, oder falls kein Tastenschlüssel als erforderlich spezifiziert worden ist, um Daten in die ausgewählte Datenzone (707) zu schreiben.

4. Eine IC-Informationskarte (10) nach Anspruch 3,
bei der Daten in jeder Zone (707) als aufeinanderfolgend angeordnete Datensätze (722, ..., 727) gespeichert werden und jedes Zonendefinitionswort (701, ..., 704) desweiteren die maximale Anzahl der Datensätze, die in der zugehörigen Zone gespeichert werden können, die Längen der Daten in jedem

Datensatz in der zugehörigen Zone und einen Zonenzuordnungsbereich (721) in der Speichereinrichtung (22), zum Abspeichern von Daten am Ort des nächsten in der zugehörigen Zone (707) zu speichernden Datensatzes anzeigt, spezifiziert.

5. IC-Informationskarte (10) nach Anspruch 4, bei der der Zonenzuordnungsbereich (721) in der zugehörigen Zone (707) angeordnet ist und eine mehrere aufeinanderfolgende geordnete Bit-Positionen enthält, die jeweils mit einer zugehörigen Datensatzposition in der Zone verknüpft sind, wobei jede Bit-Position des Zonenzuordnungsbereiches (721) einen ersten oder einen zweiten binären Zustand aufweist, der davon abhängt, ob oder ob nicht die Datensatzposition die mit dieser Bit-Position verknüpft ist, jeweils einen Datensatz enthält, und bei der die vierte Einrichtung (20) desweiteren auf den Inhalt des Zonenzuordnungsbereiches (721) der ausgewählten Zone (707) reagiert, um einen Datensatz (722, ..., 727) in der ausgewählten Zone in dieser Datensatzposition zu schreiben, die mit der niederwertigsten Bit-Position des Zonenzuordnungsbereiches (721) verknüpft ist, die den zweiten binären Zustand enthält, und zum Schreiben eines ersten binären Zustandes in diese niederwertigste Bit-Position, die den zweiten binären Zustand enthält.

6. IC-Informationskarte (10) nach Anspruch 4, bei der jeder Datensatz (722, ..., 727), der in einer Datenzone (707) gespeichert ist ein Prüfsummen-Byte und ein zweites Zustands-Byte aufweist, das die Gültigkeit der Daten in dem Datensatz (722, ..., 727) anzeigt.

7. IC-Informationskarte (10) nach Anspruch 4, bei der jedes Zonendefinitionswort (701, ..., 704) desweiteren spezifiziert, ob die der Eingabe/Ausgabe-Einrichtung (24) durch die dritte Einrichtung (20) bereitgestellten Daten in Antwort auf einen Lesebefehl und einen von der zugehörigen Zone (707) zu lesenden Daten spezifizierenden Code nur der letzte Datensatz ist, der in die zugehörige Zone (707) oder alle Datensätze (722, ..., 727) ist, die in der zugehörigen Zone (707) in der Reihenfolge gespeichert sind, in der diese Datensätze (722, ... 727) in die zugehörige Zone (707) geschrieben sind.

8. IC-Informationskarte (10) nach Anspruch 3, bei der der dritte Bereich der Speichereinrichtung (22) desweiteren eine Vielzahl von aufeinanderfolgend geordneten Sperrzustandsworten enthält, die ein erstes und ein letztes Sperrzustandswort umfassen, wobei jedes Sperrzustandswort eine vorbestimmte Anzahl von aufeinanderfolgend geordneten Bit-Positionen aufweist, die eine erste und eine letzte Bit-Position umfassen, wobei jede Bit-Position jedes Sperrzustandswortes ursprünglich in einem zweiten binären Zustand ist, und wobei die Karte desweiten eine fünfte Einrichtung (20) in der Karte aufweist, die auf eine nicht zustandegekommene Übereinstimmung eines eingegebenen Tastenschlüssels mit einem in der Karte gespeicherten Tastenschlüssel als Ergebnis eines Tastenschlüsselvergleichs reagiert, der durch die erste (20), zweite (20), dritte (20) oder vierte (20) Einrichtung ausgeführten Vergleiches wurde, um einen ersten binären Zustand in die niederwertigste Bit-Position zu schreiben, die in dem zweiten binären Zustand des niederwertigsten Verriegelungszustandswortes ist, in der die höchstwertige Bit-Position in dem zweiten binären Zustand ist, wobei die fünfte Einrichtung (20) auf eine Übereinstimmung eines eingegebenen Tastenschlüssels mit einem in der Karte gespeicherten Tastenschlüssel reagiert, die direkt nach einem Fehlschlagen einer Übereinstimmung eines eingegebenen Tastenschlüssels mit einem in der Karte gespeichertem Tastenschlüssel als ein Ergebnis eines Vergleiches der durch die erste (20), zweite (20), dritte (20) oder vierte (20) Einrichtung ausgeführt wird, um einen ersten binären Zustand in die höchstwertige Bit-Position des Sperrzustandswortes zu schreiben, in die ein erster binärer Zustand durch die fünfte Einrichtung geschrieben worden ist, als Antwort auf das direkt vorhergegangene Fehlschlagen einer Übereinstimmung eines eingegebenen Tastenschlüssels mit einem in der Karte gespeicherten Tastenschlüssel, und daß die Karte (10) desweiteren eine sechste Einrichtung (20) in der Karte aufweist, die auf ein Verriegelungszustandswort, bei dem alle außer seiner höchstwertigen Bit-Position in dem ersten binären Zustand sind, um die Karte in einen verriegelten Zustand zu bringen, in dem wenigstens ein Lese- und Schreibzugriff zu den ersten und zweiten Bereichen der Speichereinrichtung (22) verhindert sind, und eine siebte Einrichtung (20) in der Karte vorgesehen ist, die auf einen Entriegelungsbefehl und einen oder mehrere eingegebene Tastenschlüssel zum Vergleich des eingegebenen Tastenschlüssels oder der Tastenschlüssel mit einem vorausgewählten Tastenschlüssel oder Tastenschlüsseln, die in der Karte (10) gespeichert sind, und zum Schreiben eines binären Zustands in der höchstwertigen Bit-Position des Sperrzustandswortes, bei dem sämtliche außer der höchstwertigen

Bit-Position in dem ersten binären Zustand sind, um die Karte aus ihrem gesperrten Zustand freizugeben, falls der eingegebene Tastenschlüssel oder die Tastenschlüssel mit einem vorausgewählten Tastenschlüssel oder vorausgewählten Tastenschlüsseln übereinstimmen.

9. IC-Informationskart 10 nach Anspruch 8, bei der die ersten (20), zweiten (20), dritten (20), vierten (20), fünften (20), sechsten (20) und siebten (20) Einrichtungen in einem geeignet programmierten Mikroprozessor (20) vorgesehen sind, der betriebsmäßig mit der Eingabe/Ausgabe-Einrichtung (24) verknüpft ist und die Speichereinrichtung (22) einen programmierbaren Nur-Lese-Speicher aufweist, der betriebsmäßig mit dem Mikroprozessor verbunden ist.

10. IC-Informationskartensystem mit:
einer ersten (52) und zweiten (10) IC-Informationskarte, von denen jede folgendes aufweist:
a) eine Eingabe/Ausgabe-Einrichtung (24) in der Karte, um wenigstens Daten, Befehle und Tastenschlüssel zu empfangen und wengistens Daten bereitzustellen,
b) eine Einrichtung zum Speichern eines ersten Tastenschlüssels,
c) eine nicht-flüchtige Speichereinrichtung (22) in der Karte (10), die einen ersten Bereich hat, um einen oder mehrere Tastenschlüssel zu speichern und einen zweiten Bereich, der in eine Vielzahl von Datenzonen (701, ..., 704) unterteilt ist, wobei jede der Datenzonen (707) definiert ist, um entweder keinen Tastenschlüssel oder einen oder mehrere spezifizierte des ersten Tastenschlüssel zu benötigen, und der Tastenschlüssel oder die Tastenschlüssel in dem ersten Bereich gespeichert sind, um in die Karte eingegeben zu werden, um Daten in dieser Datenzone (707) zu lesen, und um entweder keinen Tastenschlüssel oder einen oder mehrere spezifizierte der ersten Tastenschlüssel zu benötigen und der Tastenschlüssel oder die Tastenschlüssel in dem ersten Bereich gespeichert sind, um die Karte eingegeben zu werden, um Daten in dieser Datenzone (707) einzuschreiben,
d) eine erste Einrichtung (20) in der Karte, die auf die einen Lesebefehl empfangende Eingabe/Ausgabe-Einrichtung (24) reagiert, ein Code eine bestimmte der Datenzonen (707) spezifiziert, in der Daten und jeglicher eingegebene Tastenschlüssel oder Tastenschlüssel zu lesen sind, um jeglichen eingegebenen Tastenschlüssel oder Tastenschlüssel mit einem Tastenschlüssel oder Tastenschlüssel zu vergleichen, die als erforderlich spezifiziert sind, um Daten in der bestimmten Datenzone (707) zu lesen, und um Daten von der bestimmten Zone (707) an die Eingabe/Ausgabe-Einrichtung (24) bereitzustellen, falls der eingegebene Tastenschlüssel oder die Tastenschlüssel mit dem Tastenschlüssel oder den Tastenschlüsseln übereinstimmen, die als erforderlich spezifiziert sind, um Daten in der bestimmten Datenzone (707) zu lesen, oder falls kein Tastenschlüssel als erforderlich spezifiziert ist, um Daten von der bestimmten Datenzone zu lesen und
e) eine zweite Einrichtung (20) in der Karte, die auf die einen Schreibbefehl empfangende Eingabe/Ausgabe-Einrichtung (24) reagiert, einen Code, der eine ausgewählte der Datenzonen (707) spezifiziert, in die Daten einzuschreiben sind, in die ausgewählte Zone (707) einzuschreibende Daten und jegliche eingegebene Tastenschlüssel oder Tastenschlüssel zum Vergleichen jegliches eingegebenen Tastenschlüssels oder Tastenschlüsseln mit jeglichem Tastenschlüssel oder Tastenschlüsseln, die als erforderlich spezifiziert sind, um Daten in die ausgewählte Datenzone (707) zu schreiben, und um die empfangenen Daten in die ausgewählte Zone (707) zu schreiben, falls der eingegebene Tastenschlüssel oder die Tastenschlüssel mit dem Tastenschlüssel oder den Tastenschlüsseln übereinstimmen, die als erforderlich spezifiert sind, um Daten in die ausgewählte Datenzone (707) einzuschreiben, oder falls kein Tastenschlüssel als erforderlich spezifiziert ist, um Daten in die ausgewählte Zone (707) zu schreiben, wobei die Speichereinrichtung der ersten Karte (52) eine oder mehrere Datenzonen (707) aufweist, von denen jede eine entsprechende oder eine Kombination des ersten Tastenschlüssel und des Tastenschlüssel oder der Tastenschlüssel speichert, die in dem ersten Bereich der Speichereinrichtung (22) der zweiten Karte (10) gespeichert sind; und
eine IC-Karten-Leser/Schreib-Einrichtung (14) mit:
a) einem ersten (914) und einem zweiten (915) Einlaß zum Aufnehmen der ersten (52) und zweiten (10) Karten, zur jeweiligen Kopplung an die Eingabe/Ausgabe-Einrichtung (24),
b) einer Kopplungseinrichtung zum Empfangen von wengistens Befehlen, Daten und Tastenschlüsseln und zum Bereitstellen von wenigsten Daten (909),
c) einer Leser/Schreib-Speichereinrichtung (906),
d) einer ersten Einrichtung (908), die auf die Kopplungseinrichtung (909) reagiert, die einen Befehl zum Lesen der zweiten Karte (10) empfängt, einen Code, der eine bestimmte Zone (707) in der

zweiten Karte (10) spezifiert, in der Daten zu lesen sind und jegliche der Tastenschlüssel oder Tastenschlüssel in die erste Karte (52) einzugeben sind, um der Eingabe/Ausgabe-Einrichtung (24) der ersten Karte (52) einen oder mehrere Befehle zusammen mit einem Code oder Codes bereitzustellen, die die Datenzone oder Zonen (707) der Speichereinrichtung (22) der ersten Karte (52) spezifieren, wobei der Tastenschlüssel oder die Tastenschlüssel, die notwendig sind, um in der bestimmten Zone (707) der zweiten Karte (10) Daten zu lesen, gespeichert sind und jeglicher Tastenschlüssel oder Tastenschlüssel durch die Kopplungseinrichtung (909) empfangen werden, um einen derartigen benötigten Tastenschlüssel oder Tastenschlüssel an die Leser-/Schreibspeicher-Einrichtung (906) zu übertragen, falls der Tastenschlüssel oder die Tastenschlüssel, die von der Kopplungseinrichtung (909) empfangen werden mit einem entsprechenden Tastenschlüssel oder Tastenschlüsseln übereinstimmen, die erforderlich sind, um eine oder mehrere Datenzonen (707) der Speichereinrichtung (22) der ersten Karte (52) zu lesen, oder falls keine Tastenschlüssel erforderlich sind um derartige Datenzonen (707) zu lesen, zum Bereitstellen eines Lesebefehles an die Eingabe/Ausgabe-Einrichtung (24) der zweiten Karte (10), ein Code, der die bestimmte Datenzone (707) und den Tastenschlüssel oder die Tastenschlüssel zum Lesen von Daten in der bestimmten Zone (707) spezifiziert, die von der Speichereinrichtung (22) der ersten Karte (52) an die Leser-/Schreibspeicher-Einrichtung (906) übertragen werden und zum Übertragen jeglicher Daten, die durch die Eingabe/Ausgabe-Einrichtung (24) der zweiten Karte (10) an die Leser-/Schreibspeicher-Einrichtung (906) bereitgestellt werden, und

e) eine zweite Einrichtung (908), die auf die einen Befehl zu der zweiten Karte (10) zu schreiben empfangende Kopplungseinrichtung (909) reagiert, ein Code, der eine ausgewählte Zone (707) in der zweiten Karte (10) festlegt, in die Daten einzuschreiben sind, in die ausgewählte Zone (707) einzuschreibende Daten, und jeglicher in die erste Karte (52) einzugebende Tastenschlüssel oder einzugebende Tastenschlüssel, um die Eingabe/Ausgabe-Einrichtung (24) der ersten Karte mit einem oder mehreren Befehlen zusammen mit einem Code oder Codes zu versorgen, die die Datenzone oder Zonen (707) der Speichereinrichtung (22) der ersten Karte (52) spezifizieren, wobei der Tastenschlüssel die Tastenschlüssel, die benötigt werden, um Daten in die ausgewählte Zone (707) der zweiten Karte (10) zu schreiben, gespeichert werden und jeglicher Tastenschlüssel oder Tastenschlüssel, die durch die Kopplungseinrichtung (909) empfangen werden, um einen derartigen benötigten Tastenschlüssel oder Tastenschlüssel an die Leser-/Schreibspeicher-Einrichtung (906) weiterzuleiten, falls der Tastenschlüssel oder die Tastenschlüssel, die von der Kopplungseinrichtung (909) empfangen werden, mit dem entsprechenden Tastenschlüssel oder Tastenschlüsseln übereinstimmen, die erforderlich sind, um eine oder mehrere Datenzonen (707) der Speichereinrichtung (22) der ersten Karte (52) zu lesen, oder falls keine Tastenschlüssel erforderlich sind, um derartige Datenzonen (707) zu lesen, und um der Eingabe/Ausgabe-Einrichtung (24) der zweiten Karte (10) den Schreibbefehl, einen Code, der die ausgewählte Zone (707) spezifiziert, die in die ausgewählte Zone (707) zu schreibenden Daten und den Tastenschlüssel oder die Tastenschlüssel, um Daten in die ausgewählte Zone (707) zu schreiben bereitzustellen, die von der Speichereinrichtung (22) der ersten Karte (52) zu dem Leser-/Schreibspeicher (906) übertragen werden.

11. IC-Informationskartensystem nach Anspruch 10,
bei dem die Speichereinrichtung (22) der ersten Karte (52) eine erste Datenzone (705) aufweist, die einen Identifizierungscode für die Karte (10) enthält, und bei der die Leser-/Schreibeinrichtung (14) desweiteren eine dritte Einrichtung (908) aufweist, um die erste Zone (705) der Speichereinrichtung (22) der ersten Karte (52) zu lesen, nach einem anfänglichen Koppeln der ersten Karte (52) an die Leser-/Schreibeinrichtung (14) und einem Übertragen des Identifizierungscode darin zu der Leser-/Schreibspeichereinrichtung (906), und um die erste Zone (705) der Speichereinrichtung (22) der ersten Karte (52) jedesmal zu lesen, wenn die Kopplungseinrichtung (909) einen Befehl erhält, die zweite Karte (10) zu lesen oder einen Befehl in die zweite Karte (10) zu schreiben und den darin gelesenen Inhalt mit dem Identifikationscode zu vergleichen, der in der Leser-/Schreibspeichereinrichtung (906) gespeichert ist, wobei die dritte Einrichtung (908) wenigstens ein Lesen und ein Schreiben der Speichereinrichtung (22) der zweiten Karte (10) verhindert, falls der Inhalt der ersten Datenzone (705) der Speichereinrichtung (22) der ersten Karte nicht mit dem Identifikationscode übereinstimmt, der in der Leser-/Schreibspeichereinrichtung (906) gespeichert ist.

12. Initialisierungssystem (50) für IC-Informationskarten, die jeweils eine erste Einrichtung (20) in der Karte aufweisen, die auf einen ersten Befehl, Zonendefinitionsdaten und einen von der Eingabe/Ausgabe-

Einrichtung (24) empfangenen eingegebenen Tastenschlüssel reagiert, um den eingegebenen Tastenschlüssel mit einem ersten Tastenschlüssel zu vergleichen, der in der Karte gespeichert ist, um die Zonendefinitionsdaten in einem ersten Bereich der Speichereinrichtung (22) nur dann einzuschreiben, falls der empfangene Tastenschlüssel mit dem ersten Tastenschlüssel übereinstimmt, wobei die Zonendefinitionsdaten eine oder mehrere Zonendefinitionsworte (701, ..., 704) aufweisen, von denen jedes einer jeweiligen Datenzone in einem zweiten Bereich der Speichereinrichtung entspricht, wobei jedes Zonendefinitionswort (701, ..., 704) wenigstens die Anfangsadresse der zugehörigen Datenzone (707) und die Größe der zugehörigen Datenzone (707) spezifiziert, und eine zweite Einrichtung (20) in der Karte auf einen zweiten Befehl reagiert, Tastenschlüsseldaten einen oder mehrere zustätzliche Tastenschlüssel und einen eingegebenen Tastenschlüssel aufweisen, der von der Eingabe/Ausgabe-Einrichtung (24) zum Vergleichen des eingegebenen Tastenschlüssels mit dem ersten Tastenschlüssel und zum Schreiben der Tastenschlüsseldaten in einen dritten Datenbereich der Speichereinrichtung nur dann, wenn der eingegebene Tastenschlüssel mit dem ersten Tastenschlüssel übereinstimmt, und wobei jedes Zonendefinitionswort (701, ..., 704) desweiteren festlegt, daß entweder kein Tastenschlüssel oder einer oder mehrere der ersten Tastenschlüssel und der zusätzliche Tastenschlüssel oder die zusätzlichen Tastenschlüssel notwendig sind, um von der Eingabe/Ausgabe-Einrichtung (24) empfangen zu werden, um Daten von der zugehörigen Zone (707) zu lesen und entweder kein Tastenschlüssel oder einer oder mehrere der ersten Tastenschlüssel und der zusätzliche Tastenschlüssel oder die zusätzlichen Tastenschlüssel von der Eingabe/Ausgabe-Einrichtung (24) empfangen werden müssen, um Daten in die entsprechende Datenzone (707) zu schreiben, wobei das System folgendes aufweist:
eine Eingabe-Einrichtung zum Aufnehmen jeweils einer Karte zu einem Zeitpunkt, um initialisiert zu werden und zum Koppeln der Eingabe/Ausgabe-Einrichtung (24) der dabei aufgenommenen Karte;
eine Initialisierungsspeichereinrichtung zum Speichern des ersten Tastenschlüssels, geeigneter Zonendefinitionsdaten und eines zusätzlichen Tastenschlüssels oder zusätzlicher Tastenschlüssel;
einer ersten Initialisierungseinrichtung zum Schreiben der Zonendefinitionsdaten, die in der Initialisierungsspeichereinrichtung gespeichert sind, in den ersten Bereich der Speichereinrichtung der Karte, die durch die Eingabeeinrichtung aufgenommen ist, unter Verwendung des ersten Befehles und des ersten Tastenschlüssels, der in der Intialisierungsspeichereinrichtung gespeichert ist; und
eine zweite Initialisierungseinrichtung zum Schreiben des zusätzlichen Tastenschlüssels oder zusätzlicher Tastenschlüssel, die in dem Initialisierungsspeicher gespeichert sind, in den dritten Bereich der Speichereinrichtung der Karte, die von der Eingabe-Einrichtung aufgenommen ist, unter Verwendung des zweiten Befehles und des ersten Tastenschlüssel, der in der Initialisierungsspeichereinrichtung gespeichert ist.

13. IC-Informationskarteninitialisiertungssystem (50) nach Anspruch 12, bei dem ein erster Tastenschlüssel, die Zonendefinitionsdaten und die zusätzlichen Tastenschlüssel in einer Hauptkarte (52) gespeichert sind, die in der Aufnahmeeinrichtung aufgenommen ist, bevor die erste der zu initialisierenden Karten aufgenommen ist, und das System desweiteren eine dritte Initialisierungseinrichtung aufweist, um den ersten Tastenschlüssel, die Zonendefinitionsdaten und den zusatzlichen oder die zusätzlichen Tastenschlüssel von der Kauptkarte in die Initialisierungsspeichereinrichtung zu übertragen.

14. IC-Informationskarteninitialisierungsysystem (50) nach Anspruch 12, bei der das System desweiteren eine automatische Zuführeinrichtung aufweist, um eine Vielzahl der zu initialisierenden Karten aufzunehmen und um die Karten eine nach der anderen der Aufnahmeeinrichtung zuzuführen und eine automatischen Empfangseinrichtung, um eine Karte zu empfangen, nachdem die Zonendefinitionsdaten und der zusätzliche oder die zusätzlichen Tastenschlüssel in ihre Speichereinrichtung geschrieben worden sind.

15. IC-Informationskarteninitialisierungsysystem (50) nach Anspruch 12, bei der die Karte desweiteren eine dritte Einrichtung (20) in der Karte aufweist, die auf einen Schreibbefehl reagiert, einen Code, der eine ausgewählte der Datenzonen in die Daten einzuschreiben sind spezifiziert, in die ausgewählte Zone einzuschreibende Daten und jeglichen eingegebenen Tastenschlüssel oder Tastenschlüssel, die von der Eingabe/Ausgabe-Einrichtung (24) empfangen worden sind, um jeglichen eingegebenen Tastenschlüssel oder Tastenschlüssel mit einem Tastenschlüssel oder Tastenschlüssel, die als erforderlich spezifiziert worden sind, um Daten in die ausgewählte Datenzone (707) zuschreiben, zu vergleichen und um die empfangenen Daten in die ausgewählte Datenzone (707) einzuschreiben, falls der eingegebene Tastenschlüssel oder die Tastenschlüssel mit dem Tastenschlüssel oder den Tastenschlüsseln übereinstimmen, die als erforderlich spezifiziert worden sind, um Daten in die ausgewählte

Datenzone einzuschreiben, oder falls kein Tastenschlüssel als erforderlich spezifiziert worden ist, um Daten in die ausgewählte Datenzone (707) zu schreiben, und eine zweite Speichereinrichtung (19), um einen Datei-Identifizierungscode zu speichern, und wobei das System desweiteren umfaßt:
eine Einrichtung zum Lesen der zweiten Speichereinrichtung (19), um den Datei-Identifikationscode einer von der Aufnahmeeinrichtung aufgenommenen Karte zu erhalten;
eine Massenspeichereinrichtung (16), um eine Vielzahl von Daten-Dateien zu speichern, die jeweils mit einer entsprechenden Datei-Identifikationsnummer verknüpft sind, wobei jede Daten-Datei eine Vielzahl von Datensegmenten hat, die entsprechenden Datenzonen (707) einer Karte (10) entsprechen, wie sie durch die Zonendefinitionsdaten (701, ..., 704), die in die Karte (10) durch die ersten Initialisierungseinrichtung eingeschrieben sind, definiert sind;
eine dritte Initialisierungseinrichtung, die auf den Dateienidentifikationscode reagiert, der von der Leseeinrichtung der zweiten Speichereinrichtung (19) erhalten worden ist, um die Daten-Dateien in der Massenspeichereinrichtung (16) für die Daten-Dateien mit dem Datei-Identifikationscode zu durchsuchen; und
eine vierte Initialisierungseinrichtung, um die Segmente der zugehörigen Daten-Dateien in entsprechende Datenzonen (707) der Speichereinrichtung (22) der Karte (10) zu schreiben, die in der Aufnahmeeinrichtung aufgenommen ist, unter Verwendung des Schreibbefehls und einem entsprechenden Tastenschlüssel oder Tastenschlüssel, falls diese erforderlich sind, um Daten in jede zugehörige Datenzone (707) zu schreiben.

16. IC-Informationskarteninitialisierungssystem (50) nach Anspruch 15, bei der die zweite Speichereinrichtung (19) der Karte (10) ein Magnetstreifen auf der Karte und die Einrichtung zum Lesen der zweiten Speichereinrichtung ein Magnetstreifenleser ist.

17. In einer IC-Informationskarte (10), die eine nicht-flüchtige Speichereinrichtung (22) aufweist, die eine Vielzahl von adressierbaren Bit-Speicherstellen hat, ein Verfahren zu Segmentierung eines Datenspeicherbereiches der Speichereinrichtung (22) in eine Vielzahl von Datenzone (707), wobei jede zuweisbare Attribute, inklusive einer zuweisbaren Sicherheitszugriffsebene umfaßt, wobei das Verfahren die folgenden Schritte umfaßt:
Definieren erster, zweiter und dritter Bereiche in der Speichereinrichtung (22), wobei der dritte Bereich der Datenspeicherbereich ist;
Benötigen der Eingabe in die Karte (10) wenigstens eines ersten Tastenschlüssels, um in den ersten oder in den zweiten Bereich der Speichereinrichtung (22) zu schreiben;
Schreiben wenigstens eines oder mehrerer Tastenschlüssel in den ersten Bereich der Speichereinrichtung durch Eingeben des ersten Tastenschlüssels und jeglicher zusätzlich erforderlichen Tastenschlüssel; und
Schreiben von Zonendefinitionsdaten in den zweiten Bereich der Speichereinrichtung (22) durch Eingeben des ersten Tastenschlüssel und jeglicher zusätzlicher Tastenschlüssel, wobei die Zonendefinitionsdaten ein oder mehrere Zonendefinitionsworte (701, ..., 704) aufweisen, von denen jedes einer entsprechenden Datenzone (707) in dem dritten Bereich der Speichereinrichtung (22) entspricht, wobei jedes Zonendefinitionswort wenigstens die Anfangsadresse der entsprechenden Zone (707), die Größe der entsprechenden Zone (707), und ob kein Tastenschlüssel oder ein oder mehrere des ersten Tastenschlüssels und der Tastenschlüssel oder die Tastenschlüssel in dem ersten Bereich in die Karte (10) einzugeben notwendig sind, spezifiziert, um Daten in der entsprechenden Datenzone (707) zu lesen, und ob kein Tastenschlüssel oder einer oder mehrere des ersten Tastenschlüssels und der Tastenschlüssel oder die Tastenschlüssel in dem ersten Bereich in die Karte (10) einzugeben erforderlich sind, um Daten in die zugehörige Zone (707) zu schreiben.

18. Verfahren nach Anspruch 17, bei dem Daten in jeder Datenzone (707) als aufeinanderfolgend angeordnete Datensätze (722, ..., 727) gespeichert sind, und jedes Zonendefinitionswort (701, ..., 704) desweiteren die maximale Anzahl von Datensätzen, die in der zugehörigen Zone (707) gespeichert werden können, die Länge der Daten in jedem Datensatz (722, ..., 727) in der zugehörigen Zone (707) und einen Zonenzuordnungsbereich (721) in der Speichereinrichtung (22) spezifiziert, um Daten zu speichern, die den Ort des nächsten Datensatzes (722, ..., 727) angeben, die in der zugehörigen Zone (707) gespeichert sind.

19. In einer IC-Informationskarte (10), die eine nichtflüchtige Speichereinrichtung (22) aufweist, die eine oder mehrere Datenzonen (707) hat, von denen jede die Eingabe eines entsprechenden Tastenschlüs-

sel oder einer Kombination von Tastenschlüsseln erfordert, um Daten in der Datenzone (707) zu lesen und einen entsprechenden Tastenschlüssel oder eine Kombination von Tastenschlüsseln erfordert, um Daten in die Datenzone (707) zu schreiben, ein Verfahren, um das Verbreiten des jeweiligen Tastenschlüssels oder der Tastenschlüssel, die erforderlich sind, um die Datenzonen (707) der Karte zu lesen oder zu beschreiben, zu vermeiden, mit folgenden Schritten:

Speichern des entsprechenden Tastenschlüssels oder der Tastenschlüssel, die notwendig sind, um die Datenzonen (707) der Speichereinrichtung (22) der Karte (10) zu lesen oder zu beschreiben, in einer getrennten Steuerkarte (52); und

Übertragen eines notwendigen Tastenschlüssels oder Tastenschlüssel aus der Steuerkarte (52) in die Karte (10) durch zwei Lese-/Schreib-Einrichtungen (14), indem eine ausgewählte der Datenzonen (707) in der Speichereinrichtung (22) der Karte (10) gelesen oder beschrieben wird, auszuführen ist.

Revendications

1. Une carte de support d'information sous forme de circuit intégré (10), comprenant :

des moyens d'entrée/sortie (24) dans la carte, pour recevoir au moins des données, des ordres et des codes et pour fournir au moins des données ;

des moyens de mémoire non volatile, fonctionnant en lecture/ écriture (22), incorporés dans la carte (10), ces moyens de mémoire ayant une multiplicité de positions d'enregistrement de bits adressables ;

des premiers moyens (20) incorporés dans la carte, réagissant à un premier ordre, à des données de définition de zone et à un code introduit, qui sont reçus par les moyens d'entrée/sortie (24), en comparant le code introduit avec un premier code enregistré dans la carte, et en écrivant les données de définition de zone dans une première région des moyens de mémoire (22) seulement si le code reçu concorde avec le premier code, les données de définition comprenant un ou plusieurs mots de définition de zone (701, ..., 704), correspondant chacun à une zone de données respective (707) dans une seconde région des moyens de mémoire, chaque mot de définition de zone spécifiant au moins l'adresse de début de la zone de données correspondante et la taille de cette zone.

2. Une carte de support d'information à circuit intégré (10) selon la revendication 1, dans laquelle la carte comprend en outre des seconds moyens (20) incorporés dans la carte, qui réagissent à un second ordre, à des données de code comprenant un ou plusieurs codes supplémentaires et à un code introduit, qui sont reçus par les moyens d'entrée/sortie (24), en comparant le code introduit avec le premier code, et en écrivant les données de code dans une troisième région des moyens de mémoire seulement si le code introduit concorde avec le premier code et dans laquelle chaque mot de définition de zone définit en outre, soit aucun code soit un ou plusieurs codes parmi le premier code et le ou les codes de clé supplémentaires qui doivent être reçus par les moyens d'entrée/sortie (24) pour lire des données dans la zone correspondante, et soit aucun code, soit un ou plusieurs codes parmi le premier code et le code ou les codes supplémentaires qui doivent être reçus par les moyens d' entrée/sortie (24) pour écrire des données dans la zone de données correspondante.

3. Une carte de support d'information à circuit intégré (10) selon la revendication 2, dans laquelle la carte comprend en outre des troisièmes moyens (20) incorporés dans la carte qui réagissent au fait que les moyens d'entrée/sortie (24) reçoivent un ordre de lecture, un code spécifiant l'une particulière des zones de données (707) dans laquelle des données doivent être lues, et un ou plusieurs codes introduits quelconques, en comparant un ou plusieurs codes introduits quelconques avec un ou plusieurs codes quelconques qui sont définies comme étant exigés pour lire des données dans la zone de données particulière (707) et en fournissant des données aux moyens d'entrée/sortie (24) à partir de la zone particulière si le code ou les codes qui sont introduits concordent avec le code ou les codes qui sont définies comme étant exigés pour lire des données à partir de la zone de données particulière (707), ou si aucun code n'est défini comme étant exigé pour lire des données dans la zone de données particulière (707), et dans laquelle la carte comprend en outre des quatrièmes moyens (20) incorporés qui réagissent au fait que les moyens d'entrée/sortie (24) reçoivent un ordre d' écriture, un code spécifiant l'une des zones de de données (707) sélectionnée dans laquelle des données doivent être écrites, des données à écrire dans la zone sélectionnée, et un code ou des codes introduits quelconques, en comparant un code ou des codes introduits quelconques avec un code ou des codes quelconques définies comme étant exigés pour écrire des données dans la zone de données sélectionnée (707), et en écrivant les données reçues dans la zone de données sélectionnée (707) si le

code ou les codes introduits concordent avec le code ou les codes de clé qui sont définies comme étant exigés pour écrire des données zone de données sélectionnée (707), ou si aucun code n'est défini comme étant exigé pour écrire des données dans la zone de données sélectionnée (707).

4. Une carte de support d'information à circuit intégré (10) selon la revendication 3, dans laquelle des données sont enregistrées dans chaque zone de données (707) sous la forme d'enregistrements de données (722, ..., 727) placés en succession, chaque mot de définition de zone (701, ..., 704) définissant en outre le nombre maximal d'enregistrements de données qui peuvent être enregistrés dans la zone correspondante, la longueur des données dans chaque enregistrement de données dans la zone correspondante et une région d'allocation de zone (721) dans les moyens de mémoire (22), pour enregistrer des données indiquant l'emplacement de l'enregistrement de données suivant, à enregistrer dans la zone correspondante (707).

5. Une carte de support d'information à circuit intégré (10) selon la revendication 4, dans laquelle la région d'allocation de zone (721) est située dans la zone correspondante (707) et contient une ou plusieurs positions de bits, ordonnées en succession, chacune d'elles étant associée à une position d'enregistrement de données respective dans la zone, chaque position de bit de la région d'attribution de zone (721) contenant un premier ou un second état binaire selon que la position d'enregistrement de données associée à cette position de bit contient ou non, respectivement, un enregistrement de ces données, et dans laquelle les quatrièmes moyens (20) réagissent en outre au contenu de la région d'allocation de zone (721) de la zone sélectionnée (707), en écrivant un enregistrement de données (722, ..., 727) dans la zone sélectionnée dans la position d'enregistrement de données dans cette zone associée à la position de bit d'ordre le plus bas de la région d'allocation de zone (721) se trouvant dans la zone sélectionnée, qui contient le second état binaire, et en écrivant un premier état binaire dans cette position de bit d'ordre le plus bas contenant le second état binaire.

6. Une carte de support d'information à circuit intégré (10) selon la revendication 4, dans laquelle chaque enregistrement de données (722, ..., 727) enregistré dans une zone de données (707), contient un multiplet de contrôle de sommation et un second multiplet d'état, indiquant la validité des données dans l'enregistrement de données (722, ..., 727).

7. Une carte de support d'information à circuit intégré (10) selon la revendication 4, dans laquelle chaque mot de définition de zone (701, ..., 704) spécifie en outre si les données qui sont fournies aux moyens d'entrée/sortie (24) par les troisièmes moyens (20) sous la dépendance d'un ordre de lecture et d'un code spécifiant des données à lire dans la zone correspondante (707), sont seulement le dernier enregistrement de données à écrire dans la zone correspondante (707), ou sont tous les enregistrements de données (722, ..., 727) enregistrés dans la zone correspondante (707), dans l'ordre dans lequel ces enregistrements de données (722, ..., 727) sont écrits dans cette zone (707).

8. Une carte de support d'information à circuit intégré (10) selon la revendication 3, dans laquelle la troisième région des moyens de mémoire (22) comprend en outre un ensemble de mots d'état de verrouillage, ordonnés en succession, comprenant un premier et un dernier mot d'état de verrouillage, chaque mot d'état de verrouillage ayant un nombre prédéterminé de positions de bits ordonnées en succession, comprenant une première et une dernière position de bit, chaque position de bit de chaque mot d'état de verrouillage étant initialement dans un second état binaire, et dans laquelle la carte comprend en outre des cinquièmes moyens (20) incorporés dans la carte, qui réagissent au fait qu'un code introduit ne concorde pas avec un code enregistré dans la carte, d'après le résultat d'une comparaison de codes effectuée par les premiers (20), seconds (20), troisièmes (20) ou quatrièmes moyens (20), en écrivant un premier état binaire dans la position de bit d'ordre le plus bas qui est dans le second état binaire dans le mot d'état de verrouillage d'ordre le plus bas dans lequel la position de bit d'ordre le plus élevé est dans le second état binaire, les cinquièmes moyens (20) réagissant à une concordance entre un code introduit et un code enregistré dans la carte, qui se produit directement après une discordance entre un code introduit et un code enregistré dans la carte d'après le résultat de la comparaison effectuée par les premiers (20), seconds (20), troisièmes (20) ou quatrièmes moyens (20), en écrivant un premier état binaire dans la position de bit d'ordre le plus élevé du mot d'état de verrouillage dans lequel un premier état binaire a été écrit par les cinquièmes moyens (20) sous l'effet de la discordance immédiatement précédente entre un code introduit et un code enregistré dans la carte (10), dans laquelle la carte (10) comprend en outre des sixièmes moyens (20) incorporés dans la

carte, qui réagissent au fait qu'un mot d'état de verrouillage a toutes ses positions de bits dans le premier état binaire, à l'exception de sa position de bit d'ordre le plus élevé, en plaçant la carte dans un état verrouillé dans lequel au moins des opérations d'accès de lecture et d'écriture aux première et seconde régions des moyens de mémoire (22) sont interdites, et des septièmes moyens (20), incorporés dans la carte, qui réagissent à un ordre de déverrouillage et à un ou plusieurs codes introduits, en comparant le code ou les codes introduits avec un code ou des codes présélectionnés qui sont enregistrés dans la carte (10), et en écrivant un premier état binaire dans la position de bit d'ordre le plus élevé du mot d'état de verrouillage ayant toutes ses positions de bit dans le premier état binaire, à l'exception de sa position de bit d'ordre le plus élevé, afin de faire sortir la carte de l'état verrouillé, si le code ou les codes qui sont introduits concordent avec le code ou les codes présélectionnés.

9. Une carte de support d'information à circuit intégré (10) selon la revendication 8, dans laquelle les premiers (20), seconds (20), troisièmes (20), quatrièmes (20), cinquièmes (20), sixièmes (20) et septièmes moyens (20) sont inclus dans un microprocesseur (20), programmé de façon appropriée, connecté fonctionnellement aux moyens d'entrée/sortie (24), les moyens de mémoire (22) contenant une mémoire morte programmable, qui est connectée fonctionnellement au microprocesseur.

10. Un système de cartes de support d'information à circuit intégré comprenant :

une première (52) et une seconde (10) cartes d'information à circuit intégré, ayant chacune :

(a) des moyens d'entrée/sortie (24) incorporés dans la carte pour recevoir au moins des données, des ordres et des codes et pour fournir au moins des données,

(b) des moyens enregistrant un premier code

(c) des moyens de mémoire non volatile (22) incorporés dans la carte (10), ayant une première région pour enregistrer un ou plusieurs codes et une seconde région segmentée en un ensemble de zones de données (701, ..., 704), chacune des zones de données (707) étant définie comme exigeant l'introduction dans la carte, soit d'aucun code soit d'un ou de plusieurs codes définis parmi le premier code et le code ou les codes qui sont enregistrés dans la première région, pour lire des données dans cette zone de données (707), et comme exigeant l'introduction dans la carte, soit d'aucun code soit d'un ou de plusieurs codes définis parmi le premier code et le code ou les codes qui sont enregistrés dans la première région, pour écrire des données dans cette zone de données (707),

(d) des premiers moyens (20) incorporés dans la carte, qui réagissent au fait que les moyens d'entrée/sortie (24) reçoivent un ordre de lecture, un code spécifiant l'une particulière des zones de données (707) dans laquelle des données doivent être lues, et un code ou plusieurs codes introduits quelconques, en comparant un code ou plusieurs codes introduits quelconques avec un code ou plusieurs codes quelconques définis comme étant exigés pour lire des données dans la zone de données particulière (707), et en fournissant des données aux moyens d'entrée/sortie (24) à partir de la zone particulière (707) si le code ou les codes qui sont introduits concordent avec le code ou les codes qui sont définis comme étant exigés pour lire des données dans la zone particulière (707), ou si aucun code n'est défini comme étant exigé pour lire des données dans cette zone, et

(e) des seconds moyens (20) incorporés dans la carte, qui réagissent au fait que les moyens d'entrée/sortie (24) reçoivent un ordre d'écriture, un code spécifiant l'une sélectionnée des zones de données (707) dans laquelle des données doivent être écrites, des données à écrire dans la zone sélectionnée (707), et un code ou plusieurs codes introduits quelconques, en comparant un code ou plusieurs codes introduits quelconques avec un code ou plusieurs codes quelconques définis comme étant exigés pour écrire des données dans la zone de données sélectionnées (707), et en écrivant les données reçues dans la zone sélectionnée (707) si le code ou les codes qui sont introduits concordent avec le code ou les codes définis comme étant exigés pour écrire des données dans la zone de données sélectionnée (707), ou si aucun code n'est défini comme étant exigé pour écrire des données dans la zone sélectionnée (707), les moyens de mémoire de la première carte (52) contenant une ou plusieurs zones de données (707) enregistrant chacune un code respectif ou une combinaison du premier code et du code ou des codes qui sont enregistrés dans la première région des moyens de mémoire (22) de la seconde carte (10) ; et

des moyens lecteurs/enregistreurs de carte (14) ayant :

(a) des premier (914) et second accès (915) pour recevoir respectivement la première carte (52) et la seconde carte (10), et pour être couplés aux moyens d'entrée/sortie (24) de celles-ci,

(b) des moyens de couplage pour recevoir au moins des ordres, des données et des codes et pour fournir au moins des données (909),
(c) des moyens de mémoire à lecteur/enregistreur (906),
(d) des premiers moyens (908) réagissant au fait que les moyens de couplage (909) reçoivent un ordre de lecture de la seconde carte (10), un code spécifiant une zone particulière (707) dans la seconde carte (10) dans laquelle des données doivent être écrites, et un code ou plusieurs codes quelconques à introduire dans la première carte (52), en fournissant aux moyens d'entrée/sortie (24) de la première carte (52) un ou plusieurs ordres de lecture accompagnés d'un code ou de plusieurs codes définissant la zone ou les zones de données (707) des moyens de mémoire (22) de la première carte (52) dans lesquelles le code ou les codes qui sont exigés pour lire des données dans la zone particulière (707) de la seconde carte (10) sont enregistrés, et un code ou plusieurs codes quelconques reçus par les moyens de couplage (909), en transférant ce code ou ces codes exigés vers les moyens de mémoire à lecteur/enregistreur (906) si le code ou les codes reçus par les moyens de couplage (909) concordent avec le code ou les codes respectifs qui sont exigés pour lire la zone ou les zones de données (707) des moyens de mémoire (22) de la première carte (52), ou si aucun code n'est exigé pour lire de telles zones de données (707), en fournissant aux moyens d'entrée/sortie (24) de la seconde carte (10) l'ordre de lecture, un code spécifiant la zone de données particulière (707) et le code ou les codes pour la lecture de données dans la zone particulière (707) qui sont transférées à partir des moyens de mémoire (22) de la première carte (52), vers les moyens de mémoire à lecteur/enregistreur (906), et en transférant des données quelconques qui sont fournies par les moyens d'entrée/ sortie (24) de la seconde carte (10) vers les moyens de mémoire à lecteur/enregistreur (906), et
(e) des seconds moyens (908) qui réagissent au fait que les moyens de couplage (909) reçoivent un ordre demandant d'écrire dans la seconde carte (10), un code définissant une zone sélectionnée (707) dans la seconde carte (10) dans laquelle des données doivent être écrites, des données à écrire dans la zone sélectionnée (707) et un code ou plusieurs codes quelconques à introduire dans la première carte (52), en fournissant aux moyens d'entrée/sortie (24) de la première carte (52) un ou plusieurs ordres de lecture ainsi qu'un code ou plusieurs codes spécifiant la zone ou les zones de données (707) des moyens de mémoire (22) de la première carte (52) dans lesquelles le code ou les codes qui sont exigés pour écrire des données dans la zone sélectionnée (57) de la seconde carte (10) sont enregistrés, et un code ou plusieurs codes quelconques qui sont reçus par les moyens de couplage (909), en transférant ce code ou ces codes exigés vers les moyens de mémoire à lecteur/enregistreur (906) si le code ou les codes qui sont reçus par les moyens de couplage (909) concordent avec le code ou les codes respectifs qui sont exigés pour lire la zone ou les zones de données (707) des moyens de mémoire (22) de la première carte (52), ou si aucun code n'est exigé pour lire de telles zones de données (707), et en fournissant aux moyens d'entrée/sortie (24) de la seconde carte (10) l'ordre d'écriture, un code spécifiant la zone sélectionnée (707), les données à écrire dans la zone sélectionnée (707) et le code ou les codes qui sont exigés pour écrire des données dans la zone sélectionnée (707), qui sont transférés à partir des moyens de mémoire (22) de la première carte (52) vers la mémoire à lecteur/enregistreur (906).

11. Un système de cartes de support d'information à circuit intégré selon la revendication (10), dans lequel les moyens de mémoire (22) de la première carte (52) comprennent une première zone de données (705) contenant un code d'identification pour la carte (10), et dans lequel les moyens lecteurs/enregistreurs (14) comprennent en outre des troisièmes moyens (908) pour lire la première zone (705) des moyens de mémoire (22) de la première carte (52) à la suite du couplage initial de la première carte (52) aux moyens lecteurs/enregistreurs (14), et pour transférer le code d'identification qu'elle contient vers les moyens de mémoire à lecteur/enregistreur (906), et pour lire la première zone (705) des moyens de mémoire (22) de la première carte (52) chaque fois que les moyens de couplage (909) reçoivent un ordre demandant de lire la seconde carte (10) ou un ordre demandant d'écrire dans la seconde carte (10), et pour comparer le contenu qui est lu dans cette zone avec le code d' identification qui est enregistré dans les moyens de mémoire à lecteur/enregistreur (906), les troisièmes moyens (908) empêchant au moins la lecture et l'écriture des moyens de mémoire (22) de la seconde carte (10) si le contenu de la première zone de données (705) des moyens de mémoire (22) de la première carte (52) ne concorde pas avec le code d'identification qui est enregistré dans les moyens de mémoire à lecteur/enregistreur (906).

12. Un système d'initialisation (50) pour des cartes de support d'information à circuit intégré, comprenant chacune des premiers moyens (20) incorporés dans la carte, qui réagissent à un premier ordre, à des données de définition de zone et à un code introduit qui sont reçus par les moyens d'entrée/sortie (24), en comparant le code introduit avec un premier code qui est enregistré dans la carte, en écrivant les données de définition de zone dans une première région des moyens de mémoire (22) seulement si le code reçu concorde avec le premier code, les données de définition de zone comprenant un ou plusieurs mots de définition de zone (701, ..., 704), correspondant chacun à une zone de données respective dans une seconde région des moyens de mémoire, chaque mot de définition de zone (701, ..., 704) définissant au moins l'adresse de début de la zone de données correspondante (707) et la taille de la zone de données correspondante (707), et des seconds moyens (20), incorporés dans la carte, qui réagissent à un second ordre, à des données de code comprenant un ou plusieurs codes plémentaires et à un code introduit, qui sont reçus par les moyens d'entrée/sortie (24), en comparant le code de clé introduit avec le premier code de clé et en écrivant les données de code dans une troisième région des moyens de mémoire seulement si le code introduit concorde avec le premier code et dans lequel chaque mot de définition de zone (701, ..., 704) spécifie en outre que, soit aucun code soit un ou plusieurs codes parmi le premier code et le code ou les codes supplémentaires, doivent être reçus par les moyens d'entrée/sortie (24) pour lire des données dans la zone correspondante (707), et que, soit aucun code soit un ou plusieurs codes parmi le premier code et le code ou les codes supplémentaires doivent être reçus par les moyens d'entrée/sortie (24) pour écrire des données dans la zone de données correspondante (707), le système comprenant :

des moyens d'entrée pour recevoir les cartes à initialiser, une à la fois, et pour établir un couplage avec les moyens d'entrée/sortie (24) de la carte qui est ainsi reçue ;

des moyens de mémoire d'initialisation pour enregistrer le premier code des données de définition de zone appropriées et un code ou plusieurs codes supplémentaires ;

des premiers moyens d'initialisation pour écrire les données de définition de zone qui sont enregistrées dans les moyens de mémoire d'initialisation, dans la première région des moyens de mémoire de la carte qui est reçue par les moyens d'entrée, en utilisant le premier ordre, et le premier code qui est enregistré dans les moyens de mémoire d'initialisation ; et

des seconds moyens d'initialisation pour écrire le code ou les codes supplémentaires qui sont enregistrés dans les moyens de mémoire d'initialisation, dans la troisième région des moyens de mémoire de la carte qui est reçue par les moyens d'entrée, en utilisant le second ordre, et le premier code qui est enregistré dans les moyens de mémoire d'initialisation.

13. Un système d'initialisation (50) pour des cartes d'information à circuit intégré selon la revendication 12, dans lequel le premier code les données de définition de zone et les codes supplémentaires sont enregistrés dans une carte maître (52) qui est reçue par les moyens d'entrée avant la réception de la première des cartes à initialiser, le système comprenant en outre des troisièmes moyens d'initialisation pour transférer le premier code les données de définition de zone et le code ou les codes supplémentaires de la carte maître vers les moyens de mémoire d'initialisation.

14. Un système d'initialisation (50) pour des cartes de support d'information à circuit intégré selon la revendication 12, dans lequel le système comprend en outre des moyens d'alimentation automatiques qui sont destinés à recevoir une multiplicité des cartes à initialiser, et à fournir les cartes aux moyens d'entrée, une à la fois, et des moyens de réception automatiques pour recevoir une carte après que les données de définition de zone et le code ou les codes supplémentaires ont été écrits dans les moyens de mémoire de celle-ci.

15. Un système d'initialisation (50) pour des cartes de support d'information à circuit intégré selon la revendication 12, dans lequel la carte comprend en outre des troisièmes moyens (20), incorporés dans la carte, qui réagissent à un ordre d'écriture, un code spécifiant l'une sélectionnées des zones de données dans laquelle des données doivent être écrites, des données à écrire dans la zone sélectionnée et un code ou des codes introduits quelconques, qui sont reçus par les moyens d'entrée/sortie (24), en comparant un code ou des codes introduits quelconques avec un code ou des codes quelconques qui sont définis comme étant exigés pour écrire des données dans la zone de données sélectionnées (707), et en écrivant les données reçues dans la zone de données sélectionnée (707) si le code ou les codes introduits concordent avec le code ou les codes qui sont définis comme étant exigés pour écrire des données dans la zone de données sélectionnée, ou si aucun code n'est défini comme étant exigé pour écrire des données dans la zone de données sélectionnée (707), et des

seconds moyens de mémoire (19) pour enregistrer un code d'identification de fichier, et dans lequel le système comprend en outre :

des moyens pour lire le contenu des seconds moyens de mémoire (19), afin d'obtenir le code d'identification de fichier d'une carte qui est reçue par les moyens d'entrée ;

des moyens de mémoire de masse (16) pour enregistrer une multiplicité de fichiers de données, chacun d'eux étant associé à un numéro d'identification de fichier respectif, chaque fichier de données ayant un ensemble de segments de données correspondant à des zones de données respectives (707) d'une carte (10), de la manière définie par les données de définition de zone (701, ..., 704) qui sont écrites dans la carte (10) par les premiers moyens d'initialisation ;

des troisièmes moyens d'initialisation qui réagissent au code d'identification de fichier qui est obtenu par les moyens de lecture du contenu des seconds moyens de mémoire (19), en recherchant parmi les fichiers de données dans les moyens de mémoire de masse (16) le fichier de données qui est associé à ce code d'identification de fichier ; et

des quatrièmes moyens d'initialisation pour écrire les segments du fichier de données associé dans des zones de données correspondantes (707) des moyens de mémoire (22) de la carte (10) qui est reçue par les moyens d'entrée, en utilisant l'ordre d'écriture et le code ou les codes appropriés, s'il y en a, qui sont exigés pour écrire des données dans chaque zone de données correspondante (707).

16. Un système d'initialisation (50) pour des cartes de support d'information à circuit intégré selon la revendication 15, dans lequel les seconds moyens de mémoire (19) de la carte (10) consistent en une piste magnétique sur la carte, et les moyens pour lire le contenu des seconds moyens de mémoire consistent en un lecteur de piste magnétique.

17. Dans une carte d'information à circuit intégré (10) contenant des moyens de mémoire non volatile (22) ayant une multiplicité de positions d'enregistrement de bits adressables, un procédé pour segmenter une région d'enregistrement de données des moyens de mémoire (22) en un ensemble de zones de données (707), ayant chacune des attributs pouvant leur être affectés, comprenant un niveau de sécurité d'accès pouvant être affecté, le procédé comprenant les étapes suivantes :

on définit des première, seconde et troisième régions dans les moyens de mémoire (22), la troisième région étant la région d'enregistrement de données ;

on exige l'introduction dans la carte (10) d'au moins un premier code pour écrire dans les première et seconde régions des moyens de mémoire (22) ;

on écrit un ou plusieurs codes dans la première région des moyens de mémoire en introduisant le premier code et des codes exigés supplémentaires quelconques ; et

on écrit des données de définition de zone dans la seconde région des moyens de mémoire (22) en introduisant le premier code et des codes supplémentaires quelconques, les données de définition de zone comprenant un ou plusieurs mots de définition de zone (701, ..., 704) correspondant chacun à une zone de données respective (707), dans la troisième région des moyens de mémoire (22), chaque mot de définition de zone définissant au moins l'adresse de début de la zone correspondante (707), la taille de la zone correspondante (707), et le fait qu'aucun code ou qu'un ou plusieurs des codes parmi le premier code et le code ou les codes se trouvant dans la première région, doivent être introduits dans la carte (10) pour lire des données dans la zone de données correspondante (707), et le fait qu'aucun code ou un ou plusieurs des codes parmi le premier code et le code ou les codes dans la première région, doivent être introduits dans la carte (10) pour écrire des données dans la zone correspondante (707).

18. Procédé selon la revendication 17, dans laquelle des données sont stockées dans chaque zone de données (707) sous forme d'enregistrements de données (722 à 727) situées successivement et chaque mot de définition de zone (701 à 704) spécifie en outre le nombre maximal d'enregistrements de données qui peut être stocké dans la zone (707) correspondante, la longueur des données dans chaque enregistrement de données (722 à 727) situé dans la zone (707) correspondante et une région d'allocation de zone (721) dans les moyens de mémoire (22), pour stocker des données indiquant l'emplacement des nouveaux enregistrements de données (722 à 727) à stocker dans la zone (707) correspondante.

19. Carte de support d'information sous forme de circuit intégré (10), contenant des moyens de mémoire non-volatile (22) présentant une ou plusieurs zones de données (707), chacune d'entre elles nécessitant l'entrée dans la carte (10) d'un code respectif ou d'une combinaison de codes pour lire des données

dans la zone de données (707) et un code respectif ou une combinaison de codes (707), un procédé pour empêcher la dissémination d'une connaissance du ou des codes respectifs, nécessaires pour lire ou écrire dans la zone de données (707) de la carte (10), comprenant les étapes de :

stockage du ou des codes respectifs, nécessaires pour lire ou écrire dans les zones de données (707) des moyens de mémoire (22) de la carte (10), dans une carte de commande (52) séparée; et

transfert par deux moyens lecteurs/enregistreurs de carte (14), de tout code ou codes souhaités depuis la carte de commande (52), à la carte (10), lorsqu'une lecture ou un enregistrement d'une zone sélectionnée parmi les zones de données (707), dans les moyens de mémoire (22) de la carte (10), doit être effectué.

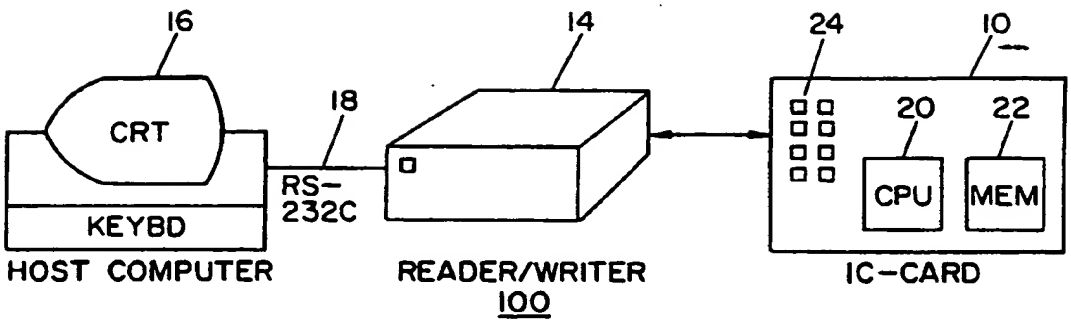


FIG. 1

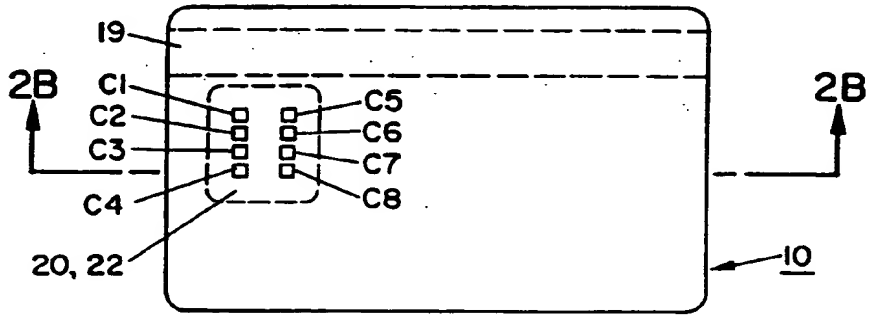


FIG. 2A

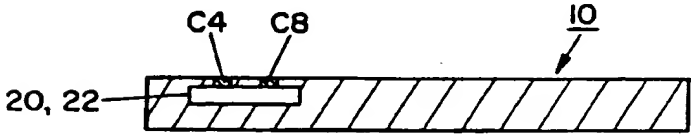


FIG. 2B

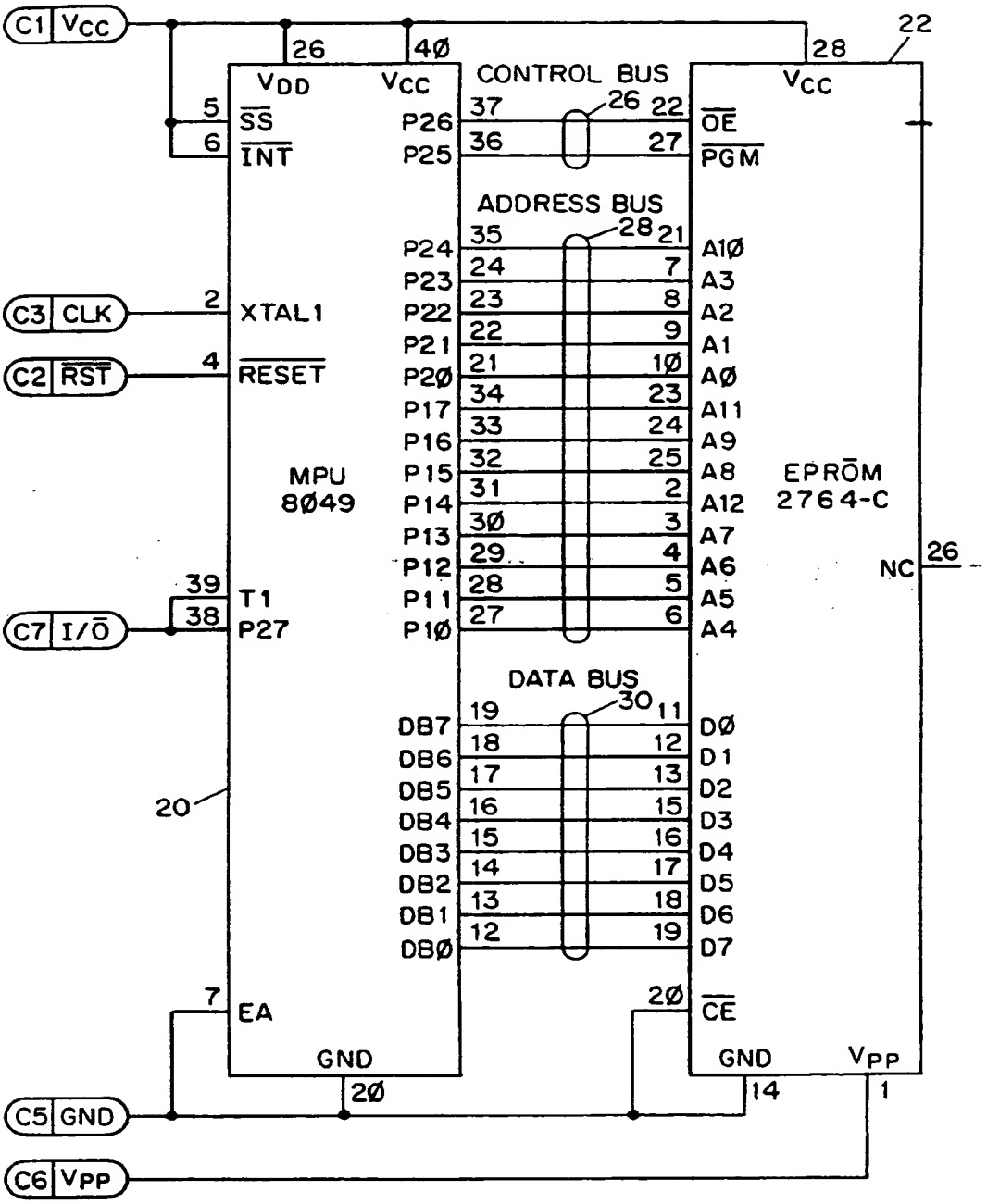

C1 VCC
C3 CLK
C2 RST
C7 I/O
C5 GND
C6 VPP
MPU 8049
EPROM 2764-C
VDD
VCC
SS
INT
XTAL1
RESET
T1
P27
EA
GND
CONTROL BUS
ADDRESS BUS
DATA BUS
P26
P25
P24
P23
P22
P21
P20
P17
P16
P15
P14
P13
P12
P11
P10
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
OE
PGM
A10
A3
A2
A1
A0
A11
A9
A8
A12
A7
A6
A5
A4
D0
D1
D2
D3
D4
D5
D6
D7
CE
NC
VPP

FIG. 3

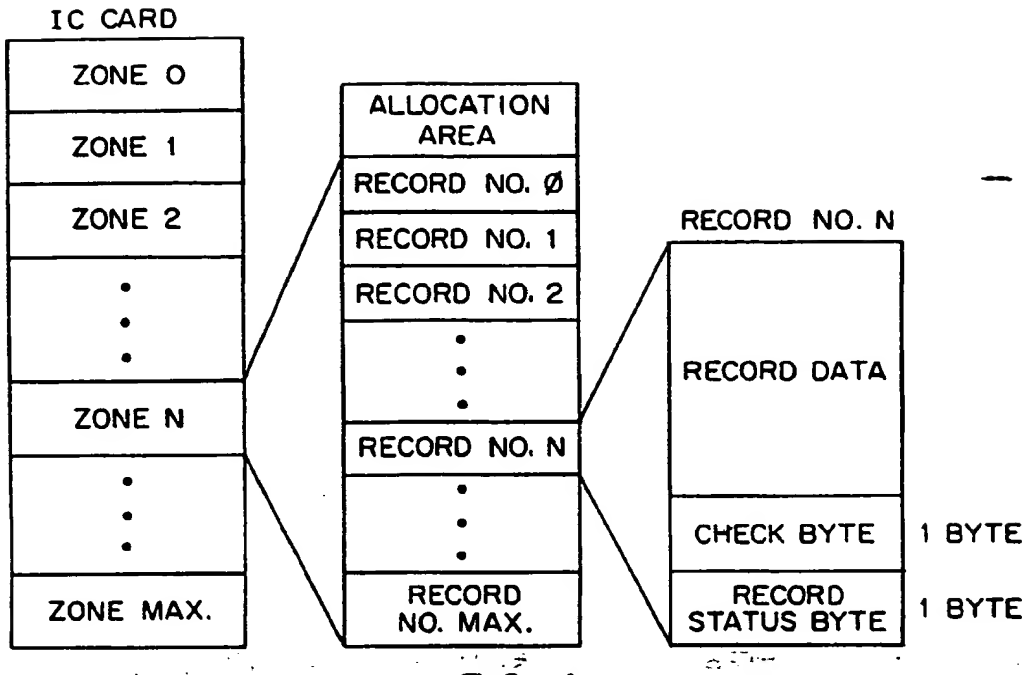


FIG. 4

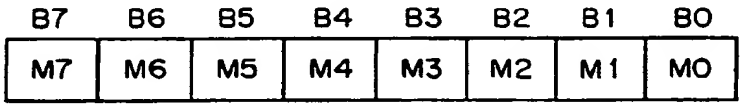
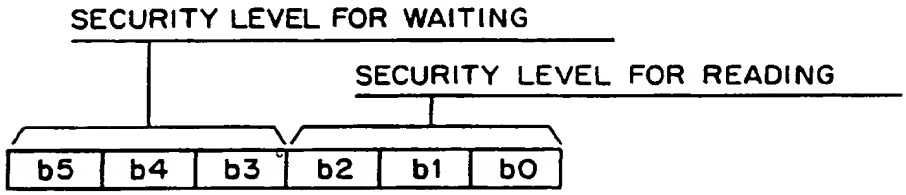


FIG. 5



CODE	REQUIRED KEY AND FUNCTIONS
000	NO ACCESS (NO R/W)
001	PIN KEY
010	ORGANIZATION KEY
011	PIN OR O-KEY
100	BOTH PIN AND O-KEY
101	PERSONALIZATION KEY
110	- - - -
111	NO KEY REQUIRED

FIG. 6

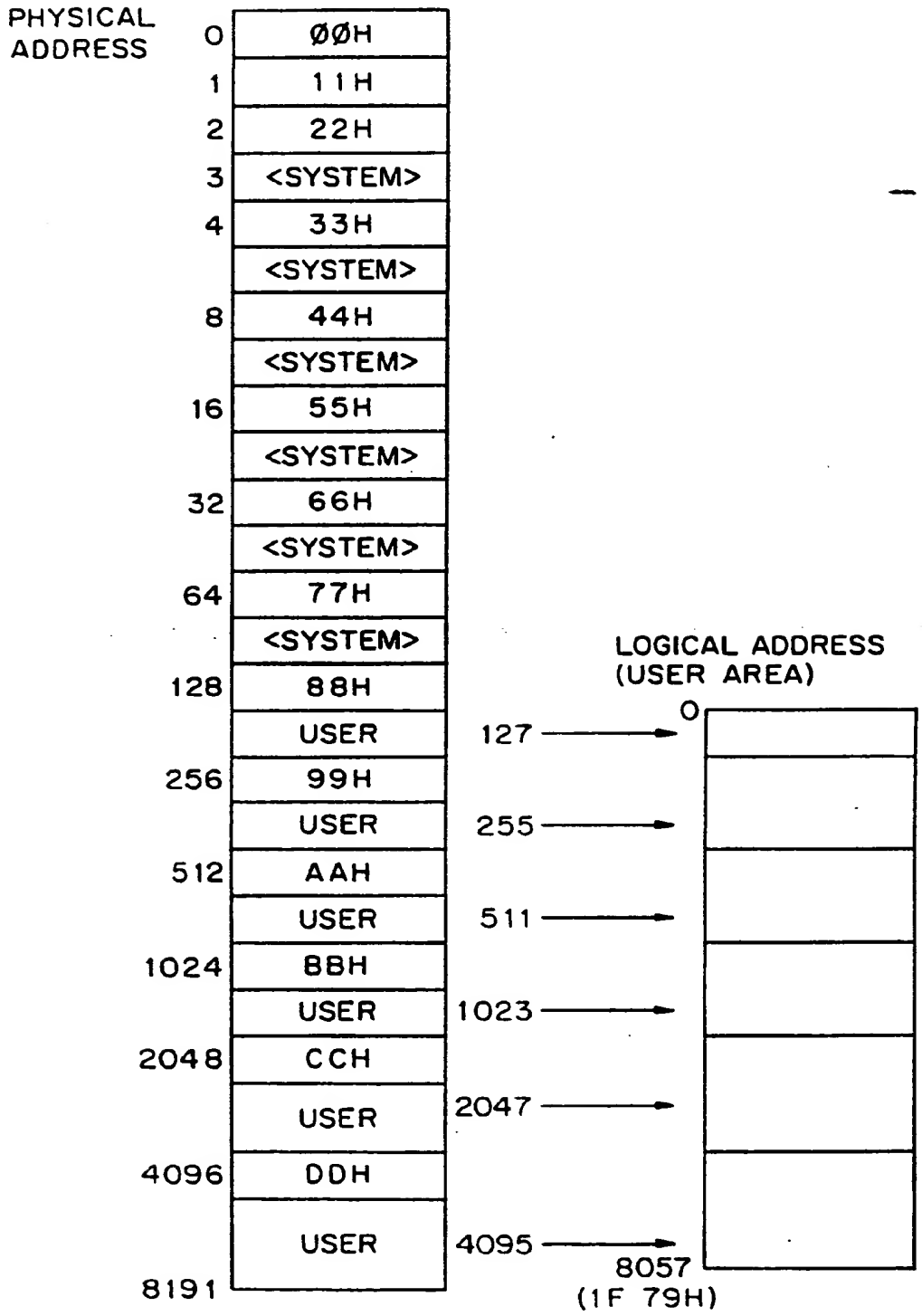

PHYSICAL ADDRESS
0
ØØH
1
11H
2
22H
3
<SYSTEM>
4
33H
<SYSTEM>
8
44H
<SYSTEM>
16
55H
<SYSTEM>
32
66H
<SYSTEM>
64
77H
<SYSTEM>
128
88H
USER
256
99H
USER
512
AAH
USER
1024
BBH
USER
2048
CCH
USER
4096
DDH
USER
8191
LOGICAL ADDRESS (USER AREA)
0
127
255
511
1023
2047
4095
8057
(1F 79H)

FIG. 7

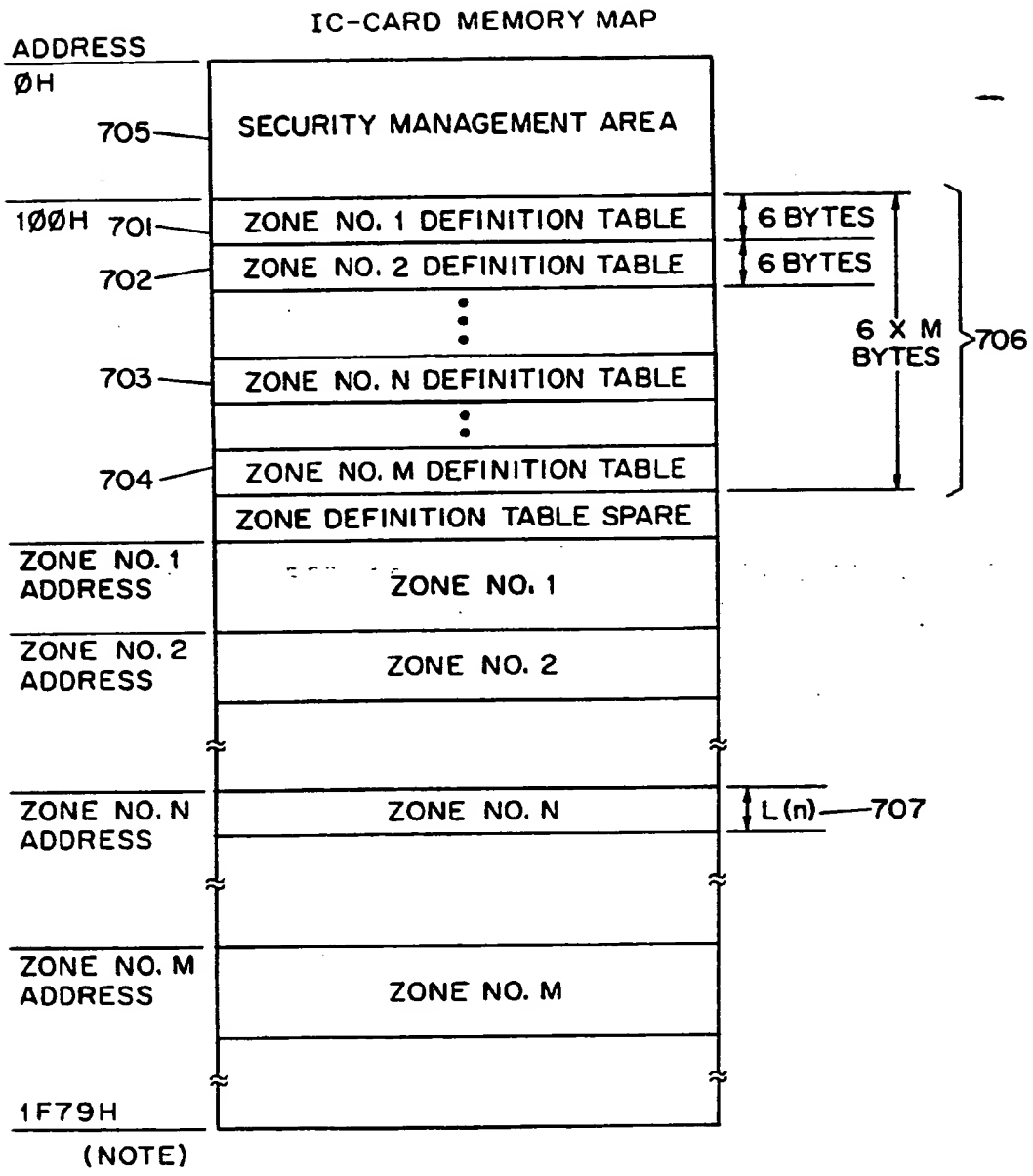

IC-CARD MEMORY MAP
ADDRESS
ØH
705
SECURITY MANAGEMENT AREA
1ØØH
701
ZONE NO. 1 DEFINITION TABLE
6 BYTES
702
ZONE NO. 2 DEFINITION TABLE
6 BYTES
6 X M BYTES
706
703
ZONE NO. N DEFINITION TABLE
704
ZONE NO. M DEFINITION TABLE
ZONE DEFINITION TABLE SPARE
ZONE NO. 1 ADDRESS
ZONE NO. 1
ZONE NO. 2 ADDRESS
ZONE NO. 2
ZONE NO. N ADDRESS
ZONE NO. N
L(n)
707
ZONE NO. M ADDRESS
ZONE NO. M
1F79H
(NOTE)

FIG. 8

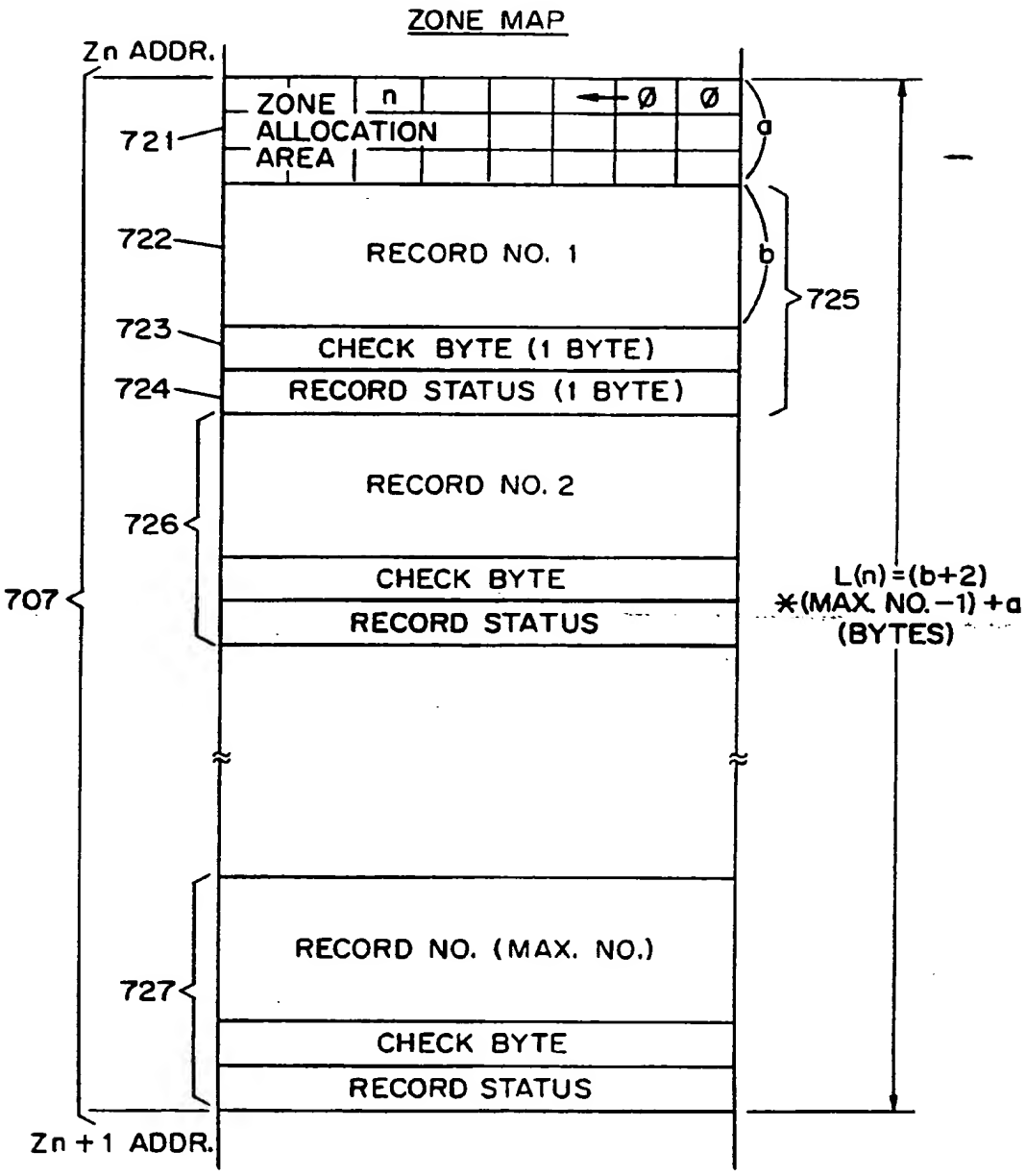

ZONE MAP
Zn ADDR.
ZONE ALLOCATION AREA
n
Ø
Ø
721
a
722
RECORD NO. 1
b
725
723
CHECK BYTE (1 BYTE)
724
RECORD STATUS (1 BYTE)
726
RECORD NO. 2
CHECK BYTE
RECORD STATUS
707
L(n)=(b+2)
*(MAX. NO.−1)+a
(BYTES)
727
RECORD NO. (MAX. NO.)
CHECK BYTE
RECORD STATUS
Zn+1 ADDR.

FIG. 8A

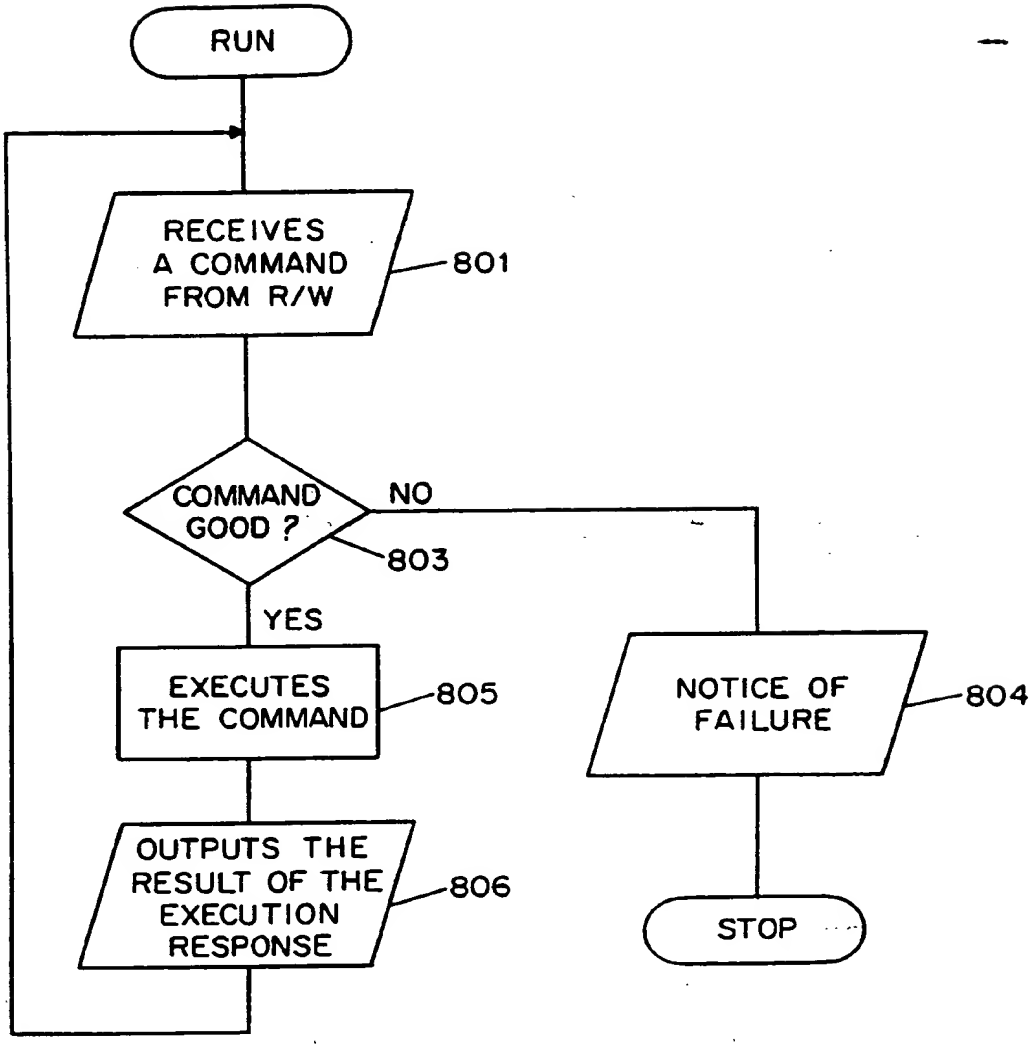

RUN
RECEIVES A COMMAND FROM R/W
801
COMMAND GOOD ?
NO
803
YES
EXECUTES THE COMMAND
805
NOTICE OF FAILURE
804
OUTPUTS THE RESULT OF THE EXECUTION RESPONSE
806
STOP

FIG. 9

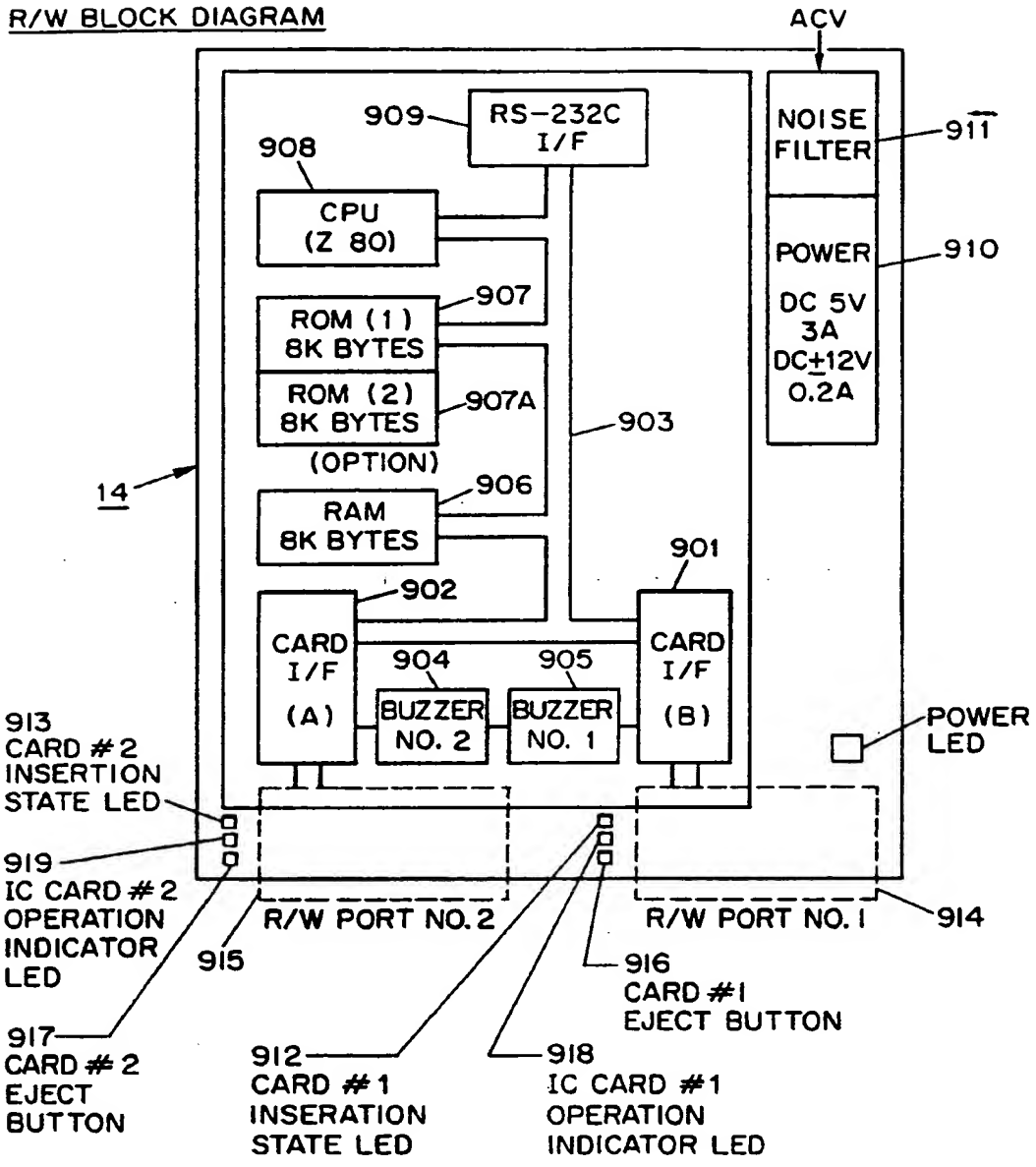

R/W BLOCK DIAGRAM
ACV
909
RS-232C I/F
908
CPU (Z 80)
907
ROM (1) 8K BYTES
ROM (2) 8K BYTES
907A
(OPTION)
903
14
906
RAM 8K BYTES
901
902
CARD I/F (A)
904
905
BUZZER NO. 2
BUZZER NO. 1
CARD I/F (B)
NOISE FILTER
911
POWER
910
DC 5V 3A
DC±12V 0.2A
POWER LED
913
CARD #2 INSERTION STATE LED
919
IC CARD #2 OPERATION INDICATOR LED
915
R/W PORT NO. 2
R/W PORT NO. 1
914
916
CARD #1 EJECT BUTTON
917
CARD #2 EJECT BUTTON
912
CARD #1 INSERATION STATE LED
918
IC CARD #1 OPERATION INDICATOR LED

FIG. 10

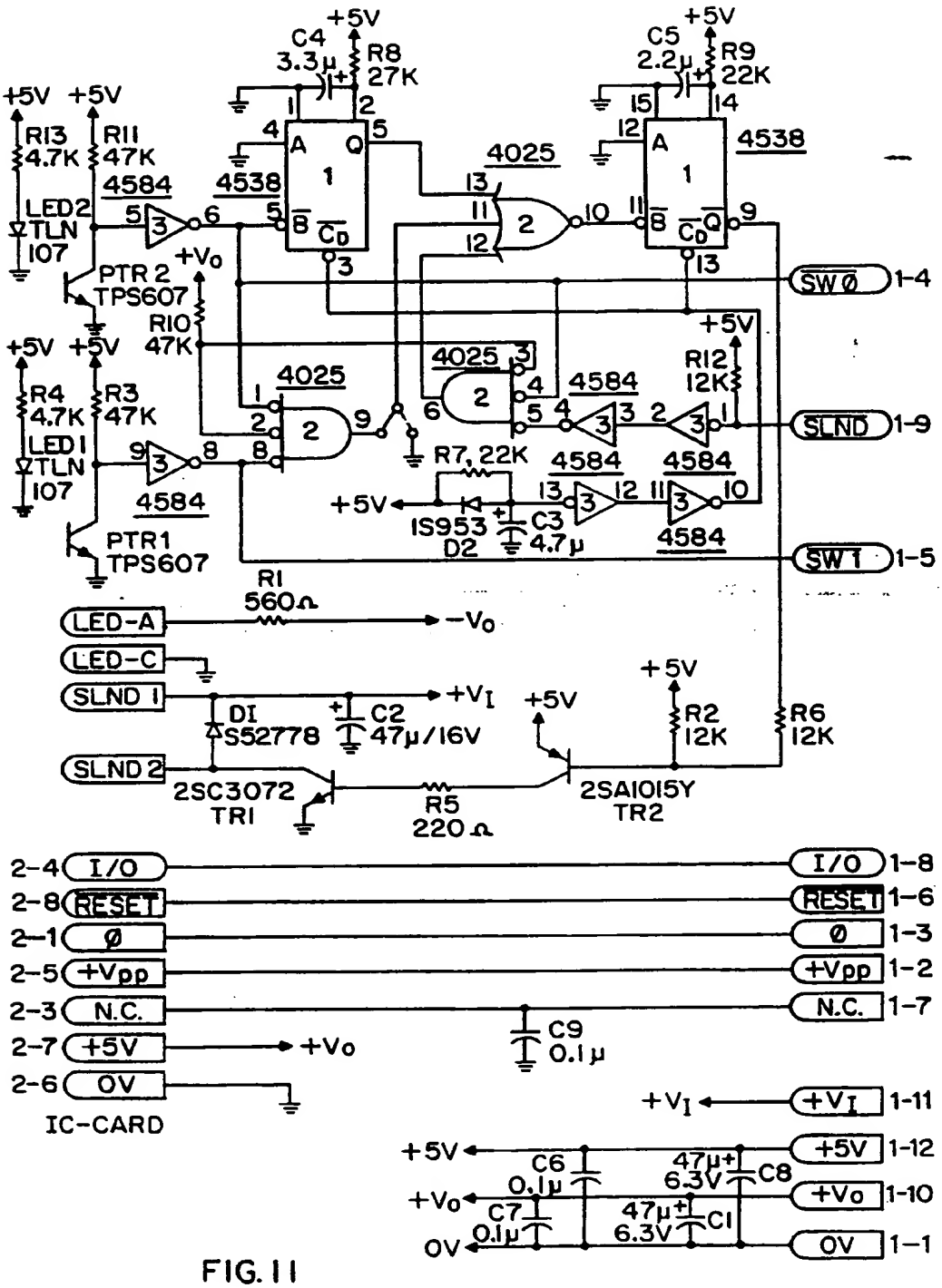

+5V
C4
3.3µ
R8
27K
C5
2.2µ
R9
22K
4538
4025
4584
RI3
4.7K
RII
47K
LED2
TLN
107
PTR 2
TPS607
+Vo
RIO
47K
R4
4.7K
R3
47K
LED1
TLN
107
PTR1
TPS607
R7, 22K
IS953
D2
C3
4.7µ
RI2
12K
SWØ
SLND
SW1
1-4
1-9
1-5
RI
560Ω
LED-A
LED-C
SLND 1
SLND 2
-Vo
+VI
DI
S52778
C2
47µ/16V
2SC3072
TRI
R5
220Ω
2SA1015Y
TR2
R2
12K
R6
12K
2-4 I/O
2-8 RESET
2-1 Ø
2-5 +Vpp
2-3 N.C.
2-7 +5V
2-6 OV
IC-CARD
I/O 1-8
RESET 1-6
Ø 1-3
+Vpp 1-2
N.C. 1-7
C9
0.1µ
+VI 1-11
+5V 1-12
+Vo 1-10
OV 1-1
C6
0.1µ
C7
0.1µ
47µ
6.3V
C8
C1

FIG. 11

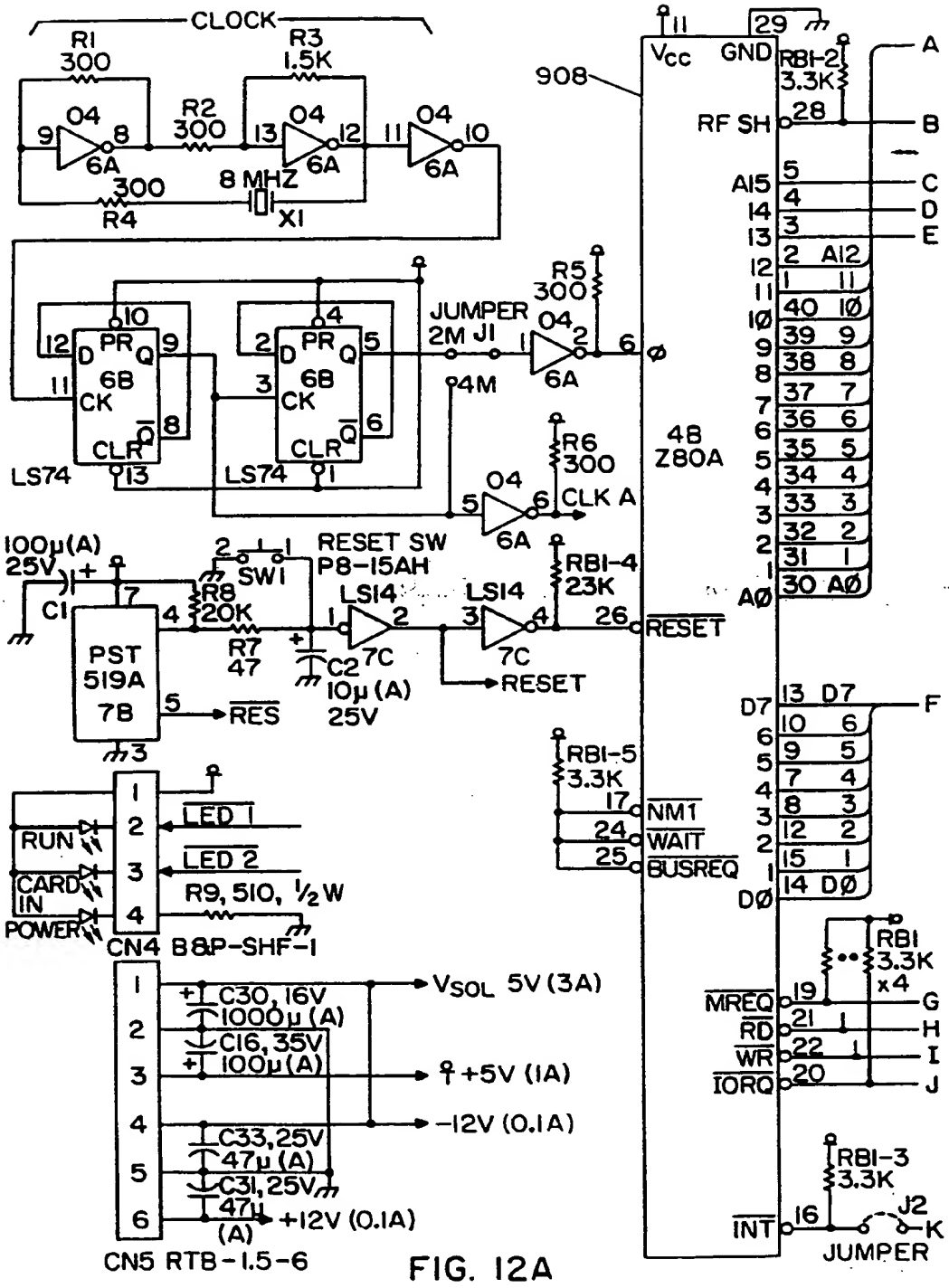

CLOCK
R1
300
R3
1.5K
R2
300
04
6A
300
R4
8 MHZ
X1
908
Vcc
GND
RF SH
48
Z80A
RBI-2
3.3K
A
B
C
D
E
F
G
H
I
J
R5
300
JUMPER
2M JI
4M
R6
300
CLK A
LS74
68
CK
PR
CLR
RESET SW
P8-15AH
SW1
R8
20K
R7
47
C1
100µ(A)
25V
C2
10µ(A)
25V
PST
519A
78
RES
LS14
7C
RESET
RBI-4
23K
RBI-5
3.3K
NM1
WAIT
BUSREQ
RBI
3.3K
x4
MREQ
RD
WR
IORQ
RBI-3
3.3K
INT
J2
JUMPER
LED 1
LED 2
RUN
CARD IN
POWER
R9, 510, ½W
CN4 B8P-SHF-1
C30, 16V
1000µ(A)
C16, 35V
100µ(A)
C33, 25V
47µ(A)
C31, 25V
47µ(A)
VSOL 5V (3A)
+5V (1A)
-12V (0.1A)
+12V (0.1A)
CN5 RTB-1.5-6

FIG. 12A

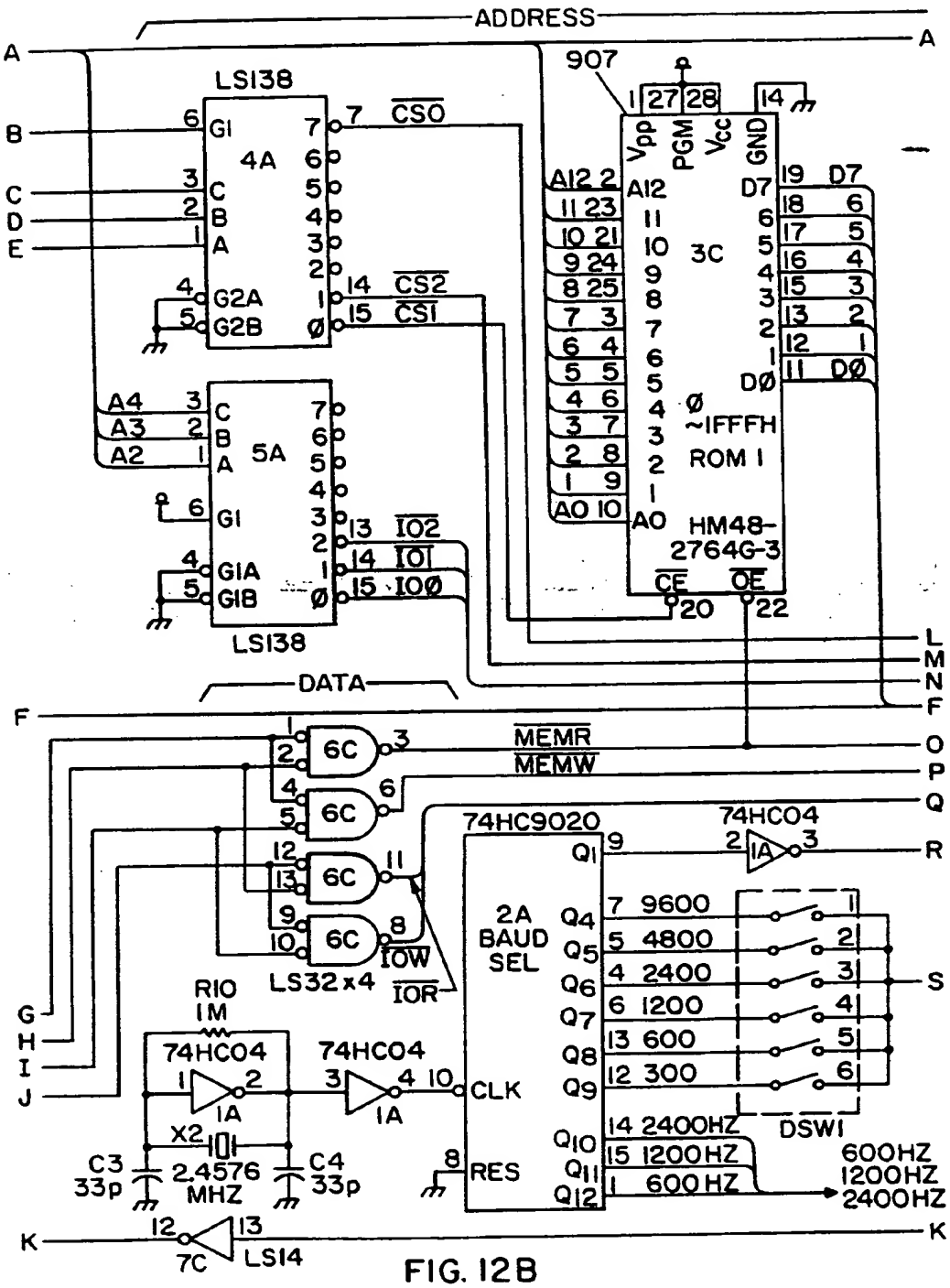

ADDRESS
DATA
LS138
4A
5A
CS0
CS2
CS1
IO2
IO1
IO0
907
HM48-2764G-3
ROM 1
~IFFFH
3C
MEMR
MEMW
IOW
IOR
LS32x4
74HC9020
2A BAUD SEL
9600
4800
2400
1200
600
300
2400HZ
1200HZ
600HZ
DSW1
74HC04
CLK
RES
X2
2.4576 MHZ
C3 33p
C4 33p
R10 1M
LS14
7C

FIG. 12B

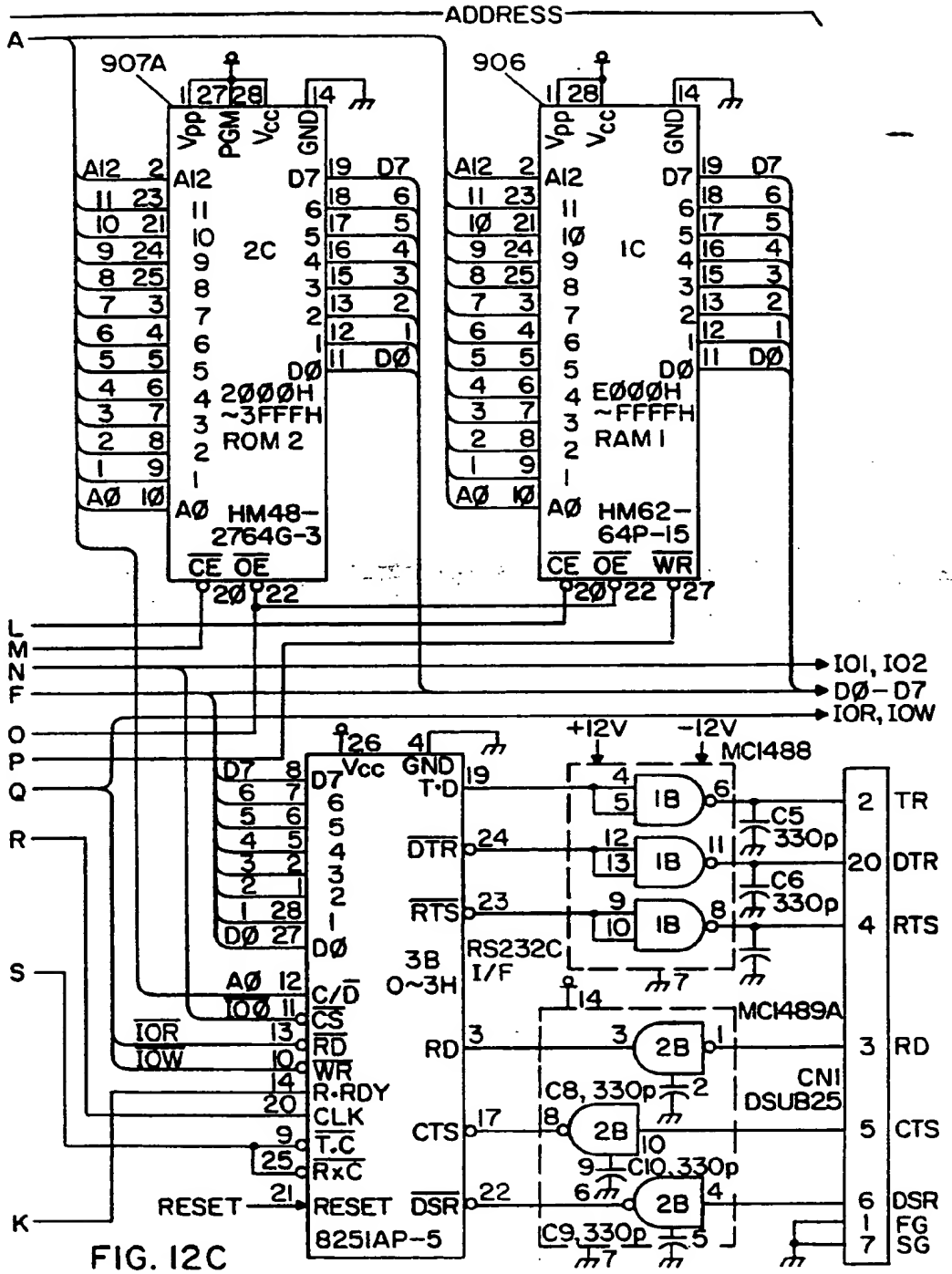
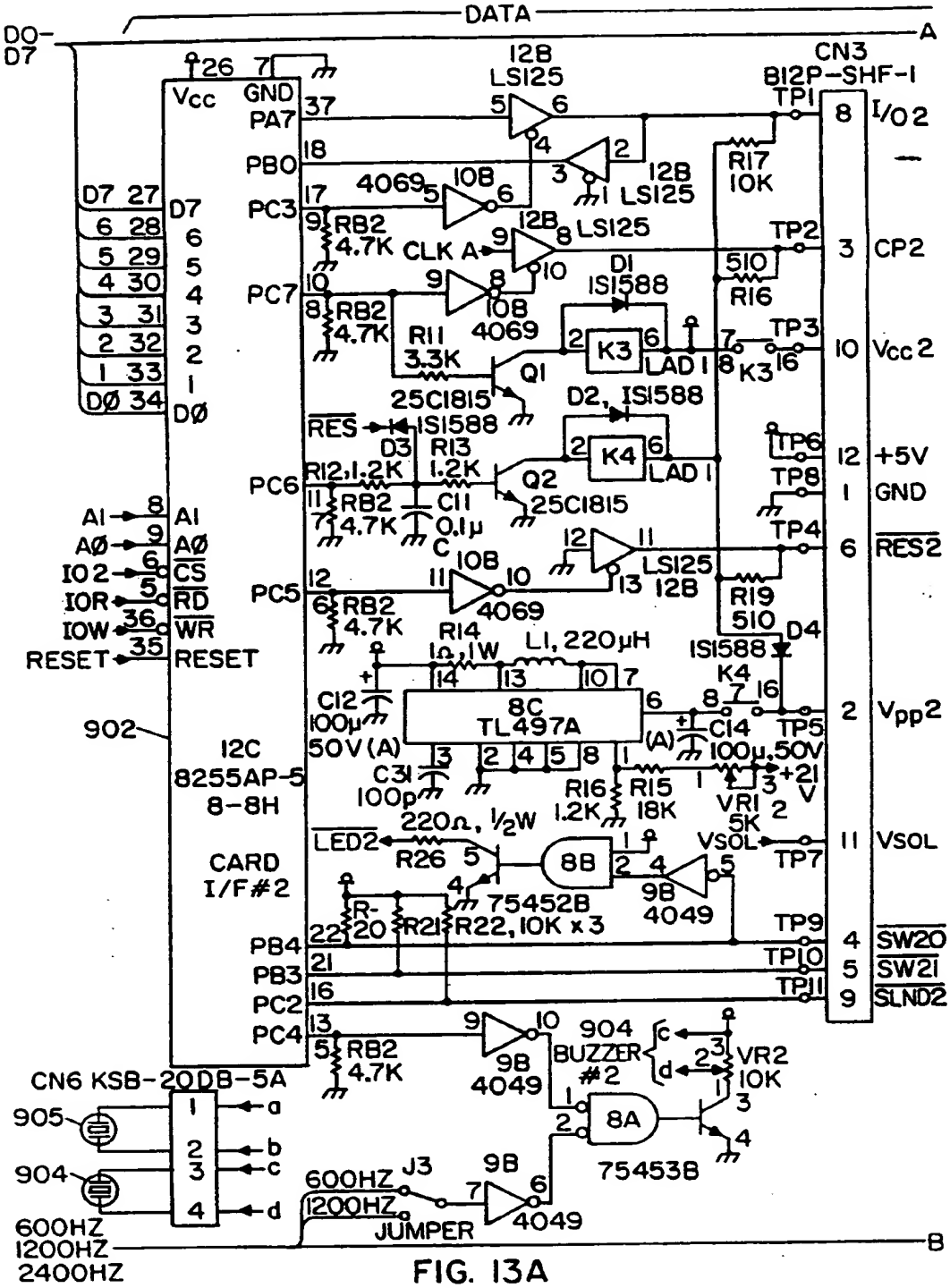

ADDRESS
907A
906
2C
ROM 2
2000H
~3FFFH
HM48-2764G-3
1C
RAM 1
E000H
~FFFFH
HM62-64P-15
8251AP-5
RS232C I/F
MC1488
MC1489A
CN1 DSUB25
C5 330p
C6 330p
C8, 330p
C9, 330p
C10, 330p
+12V
-12V
IO1, IO2
D0-D7
IOR, IOW
TR
DTR
RTS
RD
CTS
DSR
FG
SG
RESET

FIG. 12C


DATA
DO-D7
A
B
CN3 B12P-SHF-1
I/O2
CP2
Vcc2
+5V
GND
RES2
Vpp2
VSOL
SW20
SW21
SLND2
Vcc
GND
PA7
PB0
PC3
PC7
PC6
PC5
PB4
PB3
PC2
PC4
D7
DØ
AI
AØ
CS
RD
WR
RESET
I2C 8255AP-5 8-8H
CARD I/F#2
902
CN6 KSB-20DB-5A
905
904
600HZ
1200HZ
2400HZ
LS125
4069
TL497A
75452B
75453B
4049
K3
K4
LAD1
Q1
Q2
25C1815
IS1588
LED2
BUZZER #2
VR1 5K
VR2 10K
JUMPER
FIG. 13A

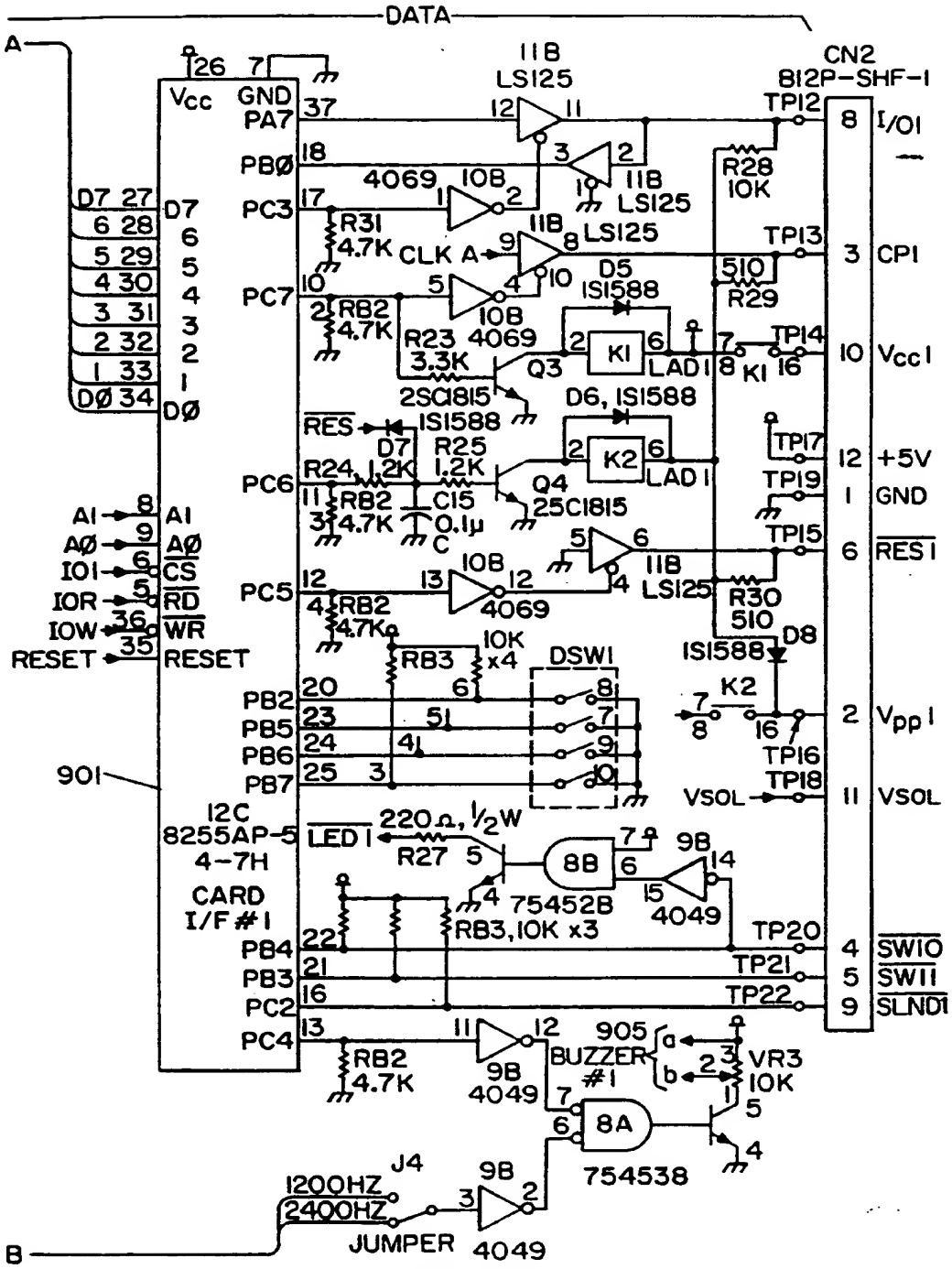

DATA
A
B
Vcc
GND
PA7
PBØ
PC3
PC7
PC6
PC5
PB2
PB5
PB6
PB7
PB4
PB3
PC2
PC4
D7
DØ
AI
AØ
CS
RD
WR
RESET
901
12C
8255AP-5
4-7H
CARD
I/F #1
11B
LS125
4069
10B
R31
4.7K
CLK A
D5
IS1588
RB2
R23
3.3K
Q3
2SC1815
K1
LAD1
D6, IS1588
RES
D7
R25
1.2K
R24
Q4
C15
0.1μ
C
DSW1
10K
x4
RB3
220Ω, ½W
LED1
R27
8B
75452B
RB3, 10K x3
9B
4049
905
BUZZER
#1
VR3
10K
8A
754538
J4
1200HZ
2400HZ
JUMPER
CN2
812P-SHF-1
TP12
R28
10K
TP13
510
R29
TP14
TP17
TP19
TP15
R30
510
D8
K2
TP16
TP18
VSOL
TP20
TP21
TP22
I/O1
CP1
Vcc1
+5V
GND
RES1
Vpp1
VSOL
SW10
SW11
SLND1

FIG. 13B

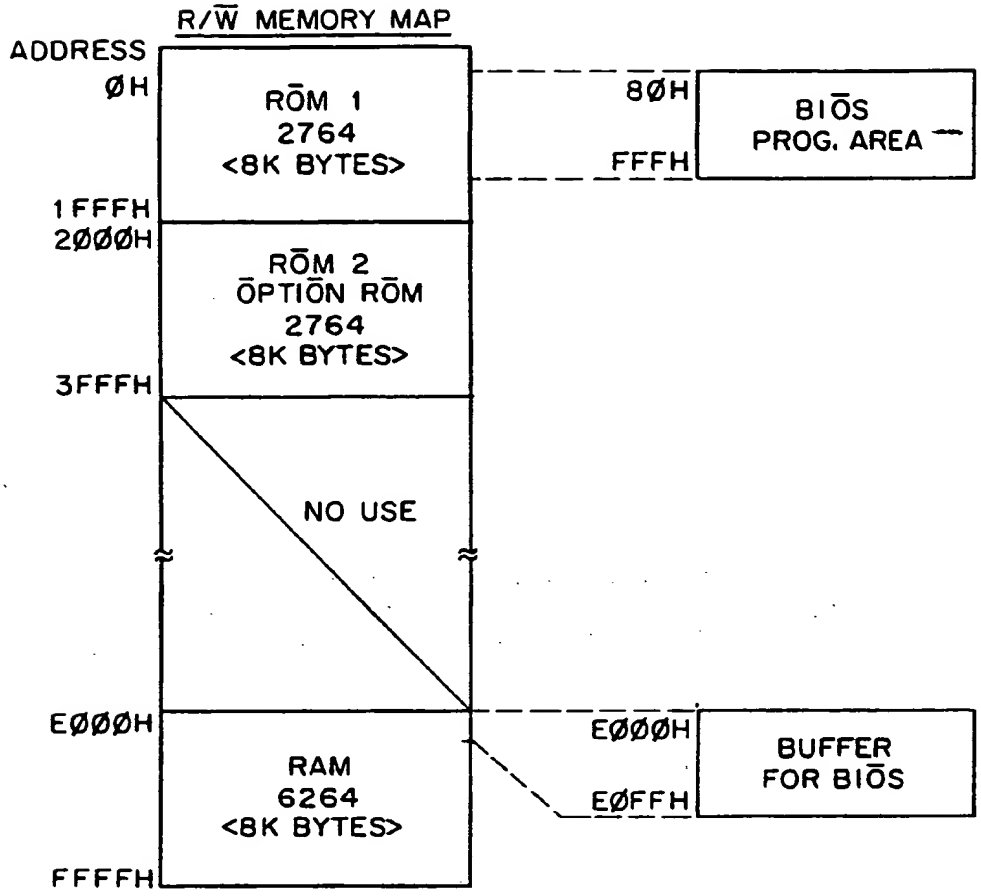

R/W MEMORY MAP
ADDRESS
ØH
ROM 1
2764
<8K BYTES>
1FFFH
2ØØØH
ROM 2
OPTION ROM
2764
<8K BYTES>
3FFFH
NO USE
EØØØH
RAM
6264
<8K BYTES>
FFFFH
8ØH
FFFH
BIOS
PROG. AREA
EØØØH
EØFFH
BUFFER
FOR BIOS

FIG. 14

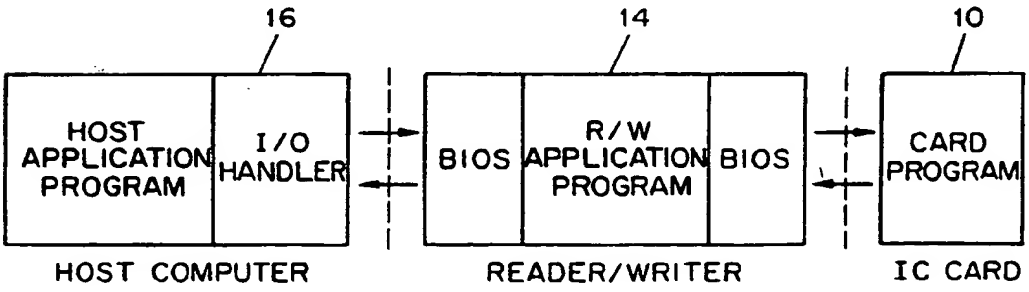

16
14
10
HOST
APPLICATION
PROGRAM
I/O
HANDLER
BIOS
R/W
APPLICATION
PROGRAM
BIOS
CARD
PROGRAM
HOST COMPUTER
READER/WRITER
IC CARD

FIG. 15

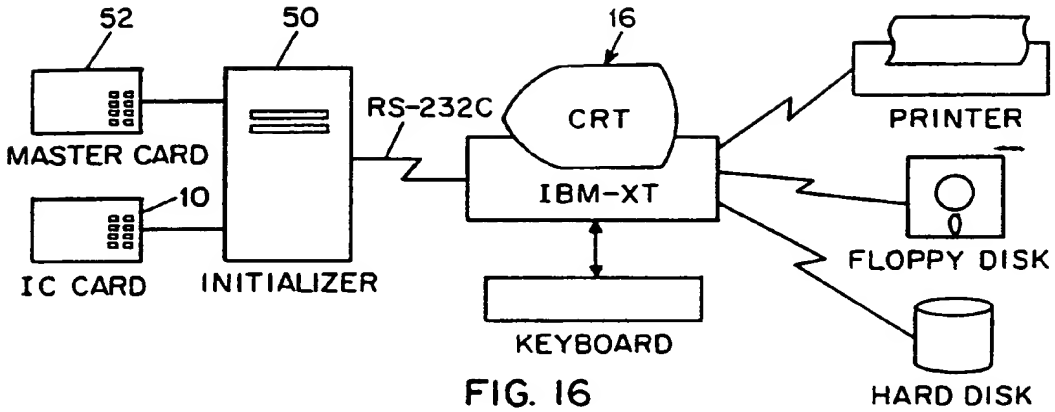


FIG. 16

MASTER CARD ZONE CONFIGURATION

ZONE #	CONTENT	SECURITY LEVEL		RECORD LENGTH
		FOR WRITE	FOR READ	
1	CARD CODE	P-KEY	$\bar{O}$-KEY	8
2	BATCH NUMBER	P-KEY	$\bar{O}$-KEY	8
3	INDICATOR	P-KEY	$\bar{O}$-KEY AND PIN	1
4	O-KEY DATA	P-KEY	$\bar{O}$-KEY AND PIN	8
5	INDICATOR	P-KEY	$\bar{O}$-KEY AND PIN	1
6	NAME INDEX	P-KEY	$\bar{O}$-KEY AND PIN	8
7	INDICATOR	P-KEY	$\bar{O}$-KEY AND PIN	1
8	Z.D.T. DATA	P-KEY	$\bar{O}$-KEY AND PIN	ℸ

FIG. 17

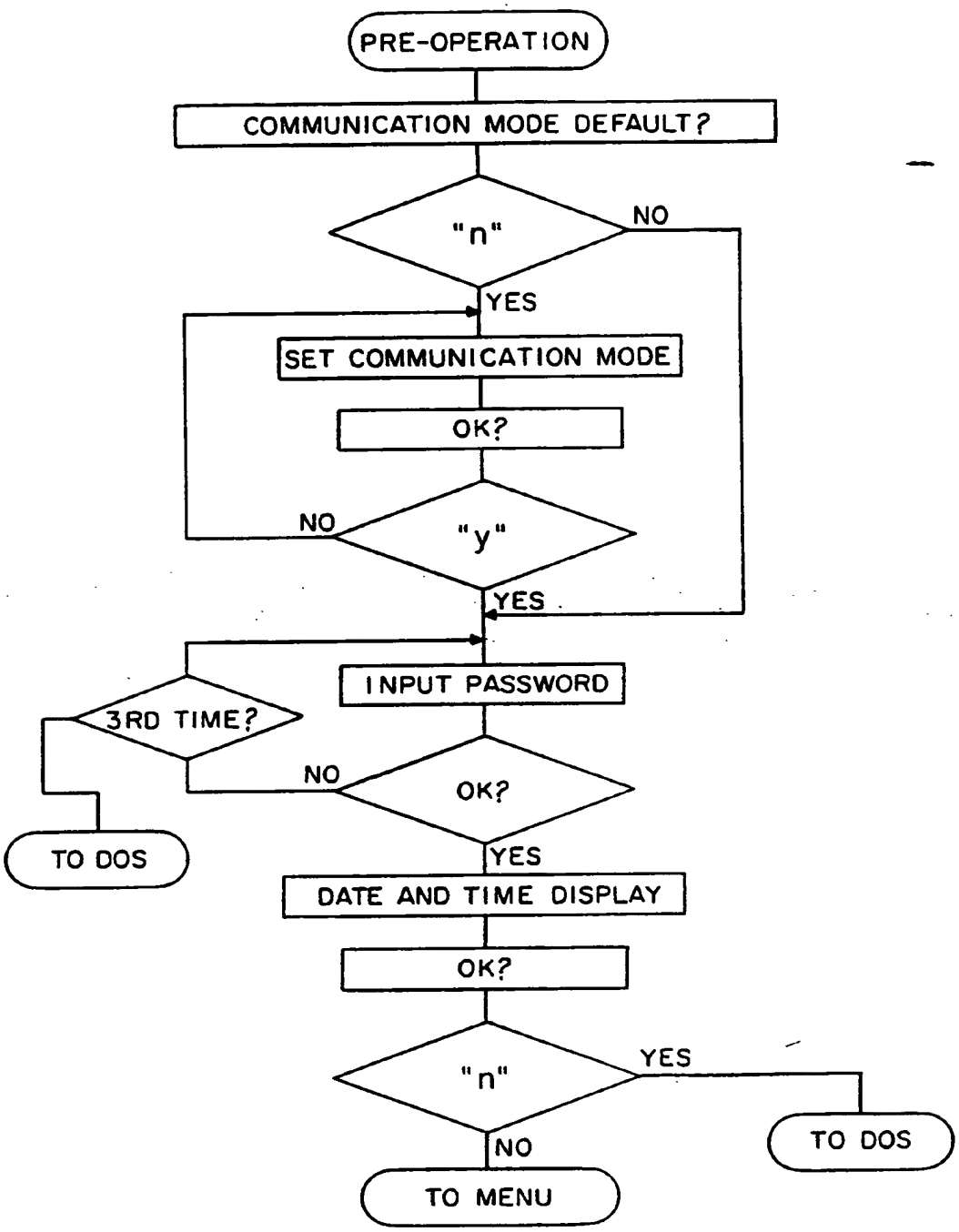

PRE-OPERATION
COMMUNICATION MODE DEFAULT?
"n"
NO
YES
SET COMMUNICATION MODE
OK?
NO
"y"
YES
INPUT PASSWORD
3RD TIME?
NO
OK?
TO DOS
YES
DATE AND TIME DISPLAY
OK?
"n"
YES
TO DOS
NO
TO MENU

FIG. 18

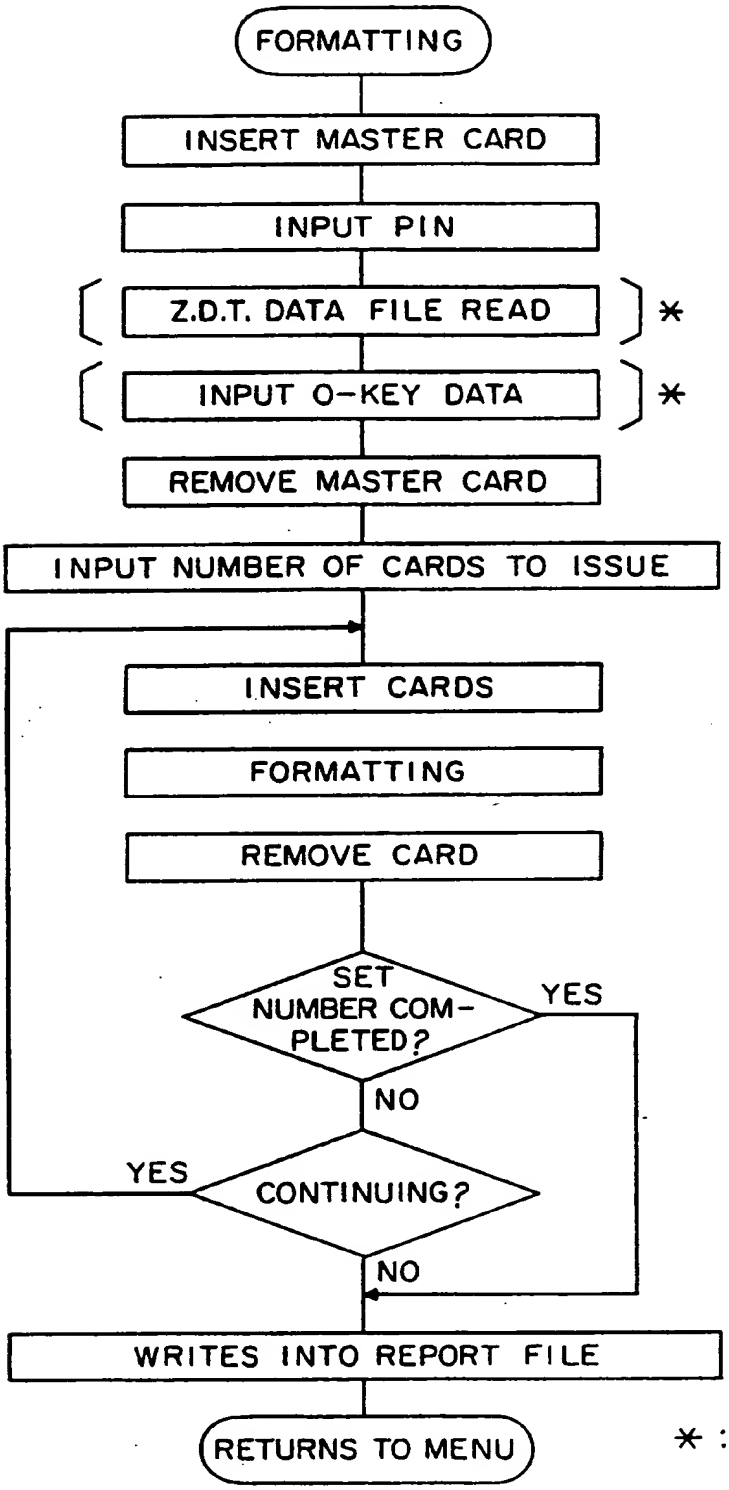

FORMATTING
INSERT MASTER CARD
INPUT PIN
Z.D.T. DATA FILE READ
*
INPUT O-KEY DATA
*
REMOVE MASTER CARD
INPUT NUMBER OF CARDS TO ISSUE
INSERT CARDS
FORMATTING
REMOVE CARD
SET NUMBER COM-PLETED?
YES
NO
YES
CONTINUING?
NO
WRITES INTO REPORT FILE
RETURNS TO MENU
* : MAY BE OMITTED.

FIG. 19

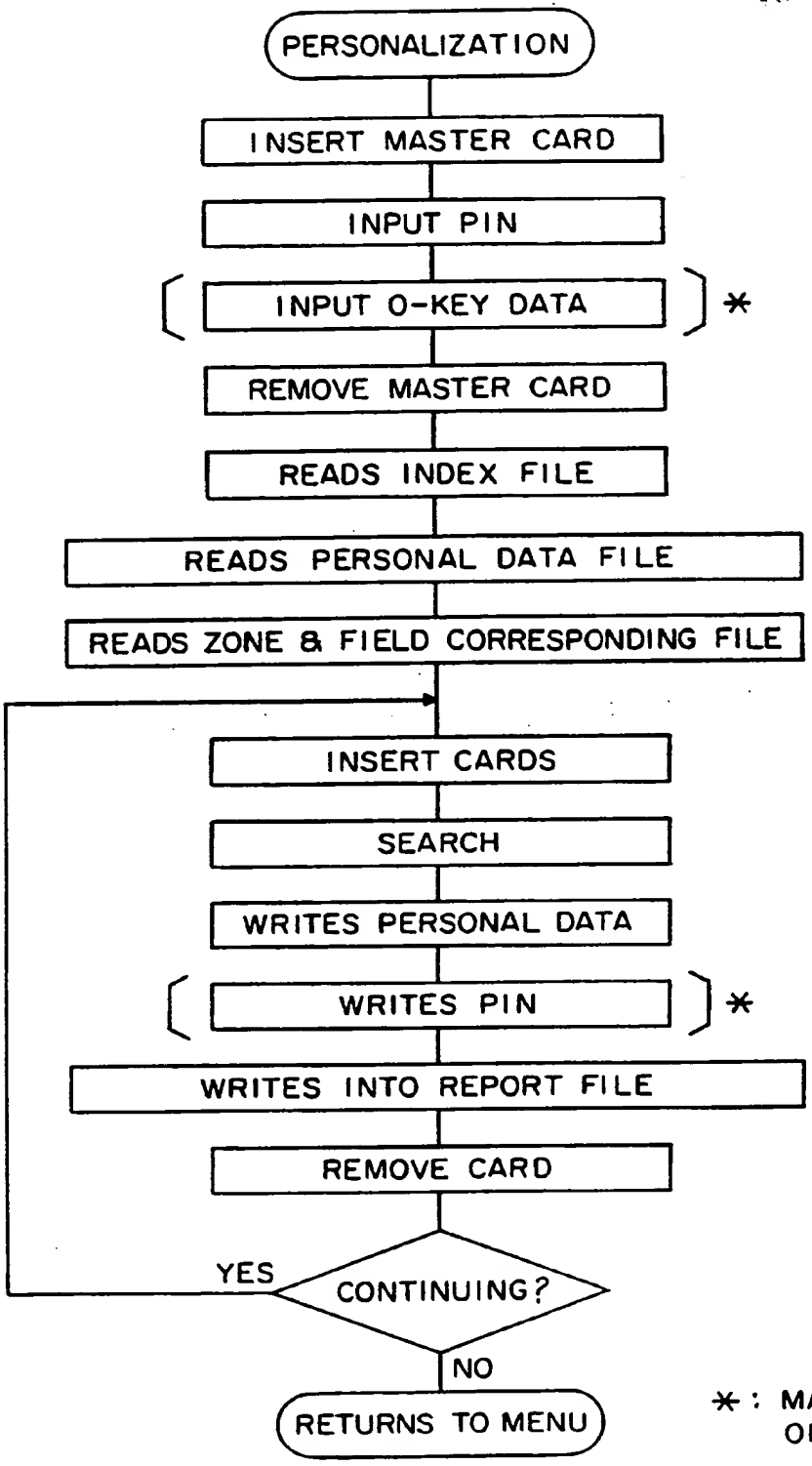

PERSONALIZATION
INSERT MASTER CARD
INPUT PIN
INPUT O-KEY DATA
*
REMOVE MASTER CARD
READS INDEX FILE
READS PERSONAL DATA FILE
READS ZONE & FIELD CORRESPONDING FILE
INSERT CARDS
SEARCH
WRITES PERSONAL DATA
WRITES PIN
*
WRITES INTO REPORT FILE
REMOVE CARD
YES
CONTINUING?
NO
RETURNS TO MENU
* : MAY BE OMITTED

FIG. 20

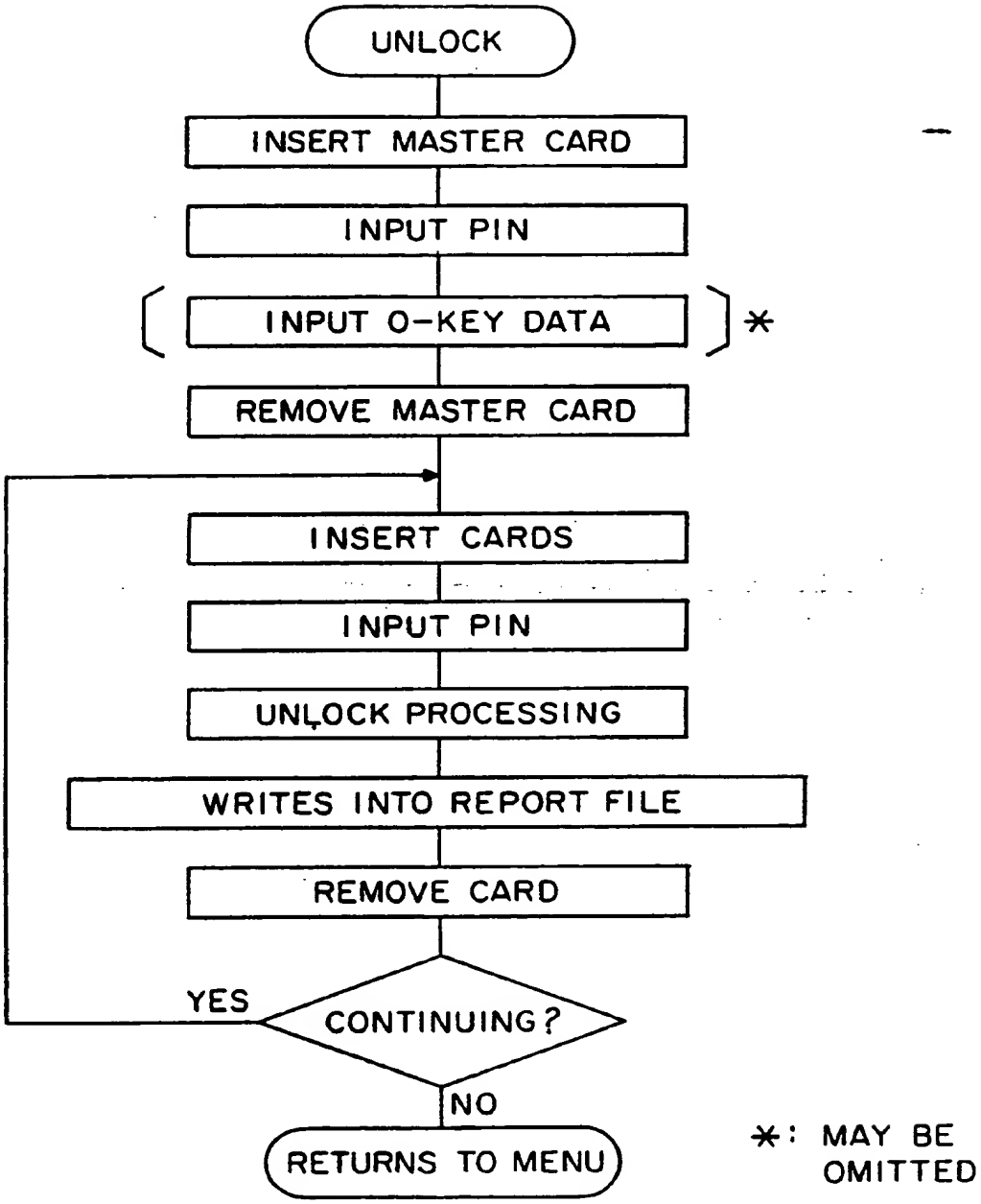

UNLOCK
INSERT MASTER CARD
INPUT PIN
INPUT O-KEY DATA
*
REMOVE MASTER CARD
INSERT CARDS
INPUT PIN
UNLOCK PROCESSING
WRITES INTO REPORT FILE
REMOVE CARD
YES
CONTINUING?
NO
RETURNS TO MENU
*: MAY BE OMITTED

FIG. 21

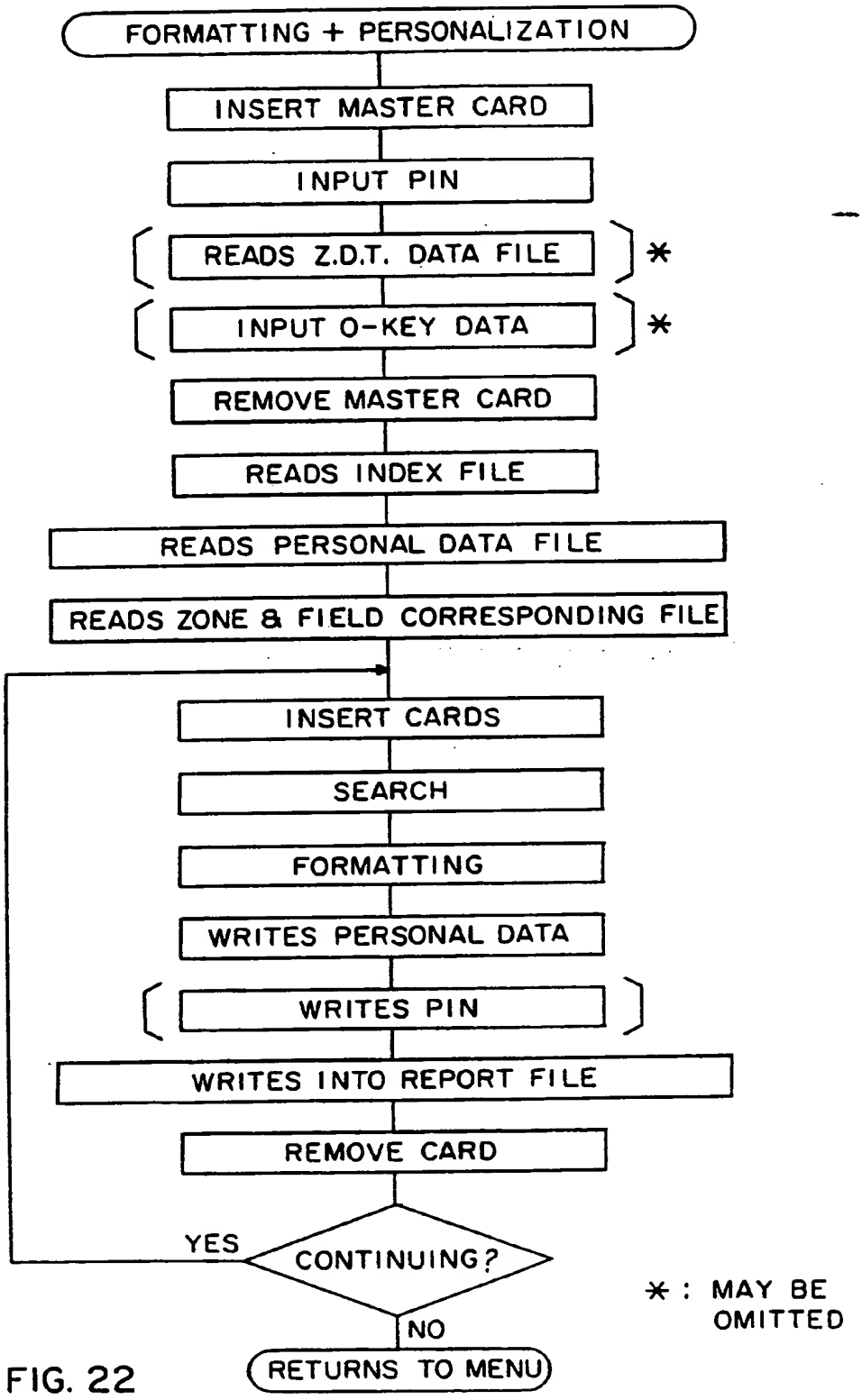

FORMATTING + PERSONALIZATION
INSERT MASTER CARD
INPUT PIN
READS Z.D.T. DATA FILE
*
INPUT O-KEY DATA
*
REMOVE MASTER CARD
READS INDEX FILE
READS PERSONAL DATA FILE
READS ZONE & FIELD CORRESPONDING FILE
INSERT CARDS
SEARCH
FORMATTING
WRITES PERSONAL DATA
WRITES PIN
WRITES INTO REPORT FILE
REMOVE CARD
YES
CONTINUING?
NO
RETURNS TO MENU
* : MAY BE OMITTED

FIG. 22

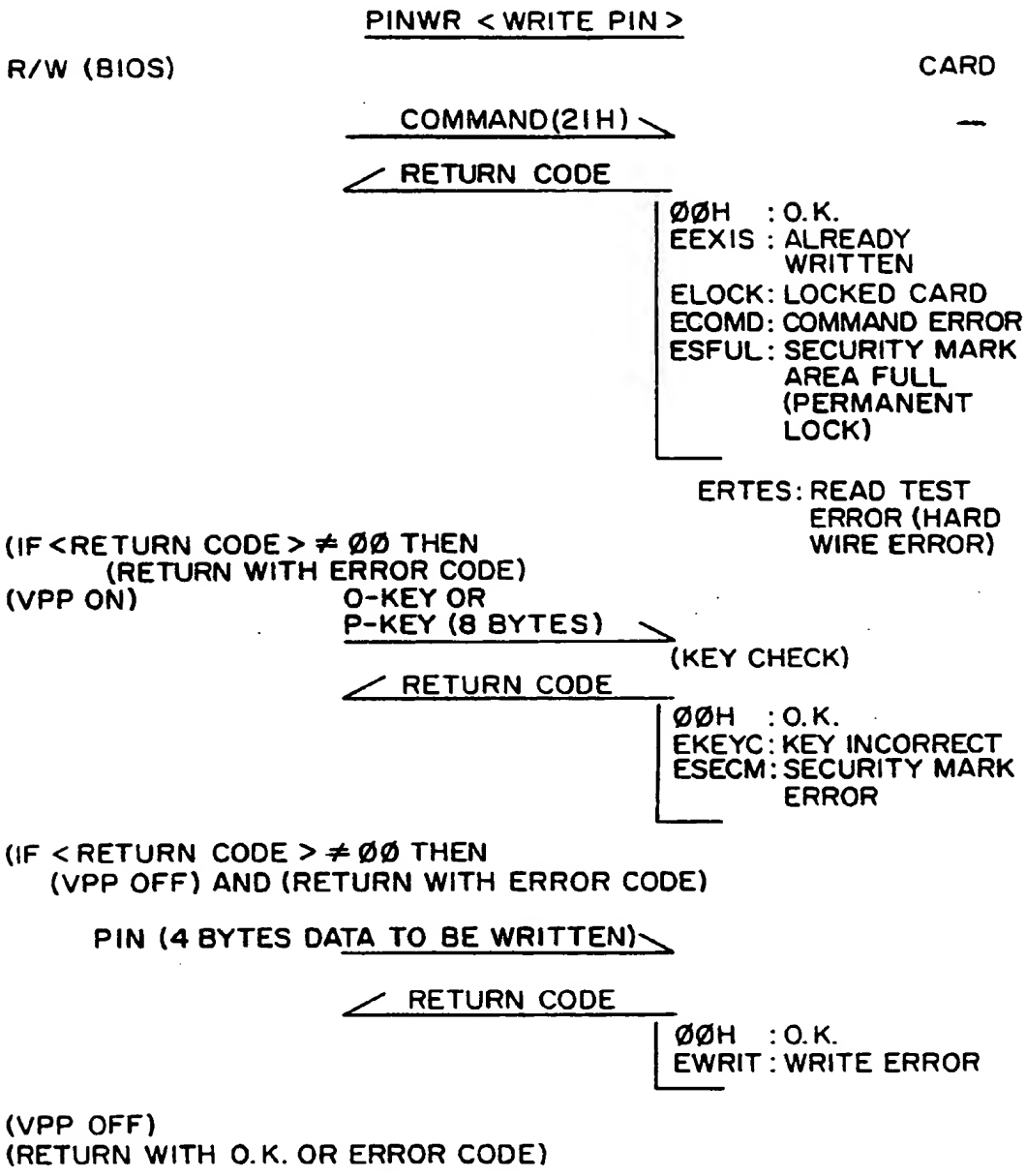

PINWR <WRITE PIN>
R/W (BIOS)
CARD
COMMAND(21H)
RETURN CODE
ØØH : O.K.
EEXIS : ALREADY WRITTEN
ELOCK: LOCKED CARD
ECOMD: COMMAND ERROR
ESFUL: SECURITY MARK AREA FULL (PERMANENT LOCK)
ERTES: READ TEST ERROR (HARD WIRE ERROR)
(IF <RETURN CODE> ≠ ØØ THEN (RETURN WITH ERROR CODE)
(VPP ON)
O-KEY OR P-KEY (8 BYTES)
(KEY CHECK)
RETURN CODE
ØØH : O.K.
EKEYC: KEY INCORRECT
ESECM: SECURITY MARK ERROR
(IF <RETURN CODE> ≠ ØØ THEN (VPP OFF) AND (RETURN WITH ERROR CODE)
PIN (4 BYTES DATA TO BE WRITTEN)
RETURN CODE
ØØH : O.K.
EWRIT : WRITE ERROR
(VPP OFF)
(RETURN WITH O.K. OR ERROR CODE)

FIG. 23

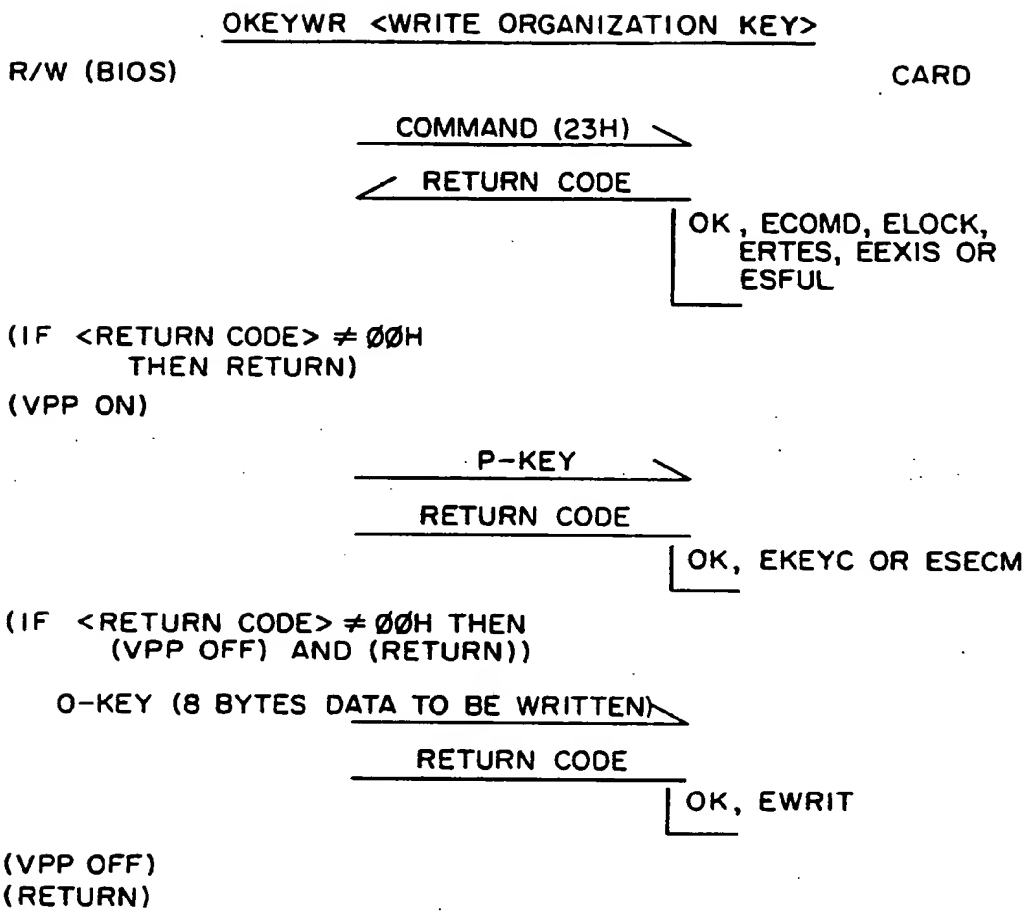

OKEYWR <WRITE ORGANIZATION KEY>
R/W (BIOS)
CARD
COMMAND (23H)
RETURN CODE
OK, ECOMD, ELOCK, ERTES, EEXIS OR ESFUL
(IF <RETURN CODE> ≠ ØØH THEN RETURN)
(VPP ON)
P-KEY
RETURN CODE
OK, EKEYC OR ESECM
(IF <RETURN CODE> ≠ ØØH THEN (VPP OFF) AND (RETURN))
O-KEY (8 BYTES DATA TO BE WRITTEN)
RETURN CODE
OK, EWRIT
(VPP OFF)
(RETURN)

FIG. 24

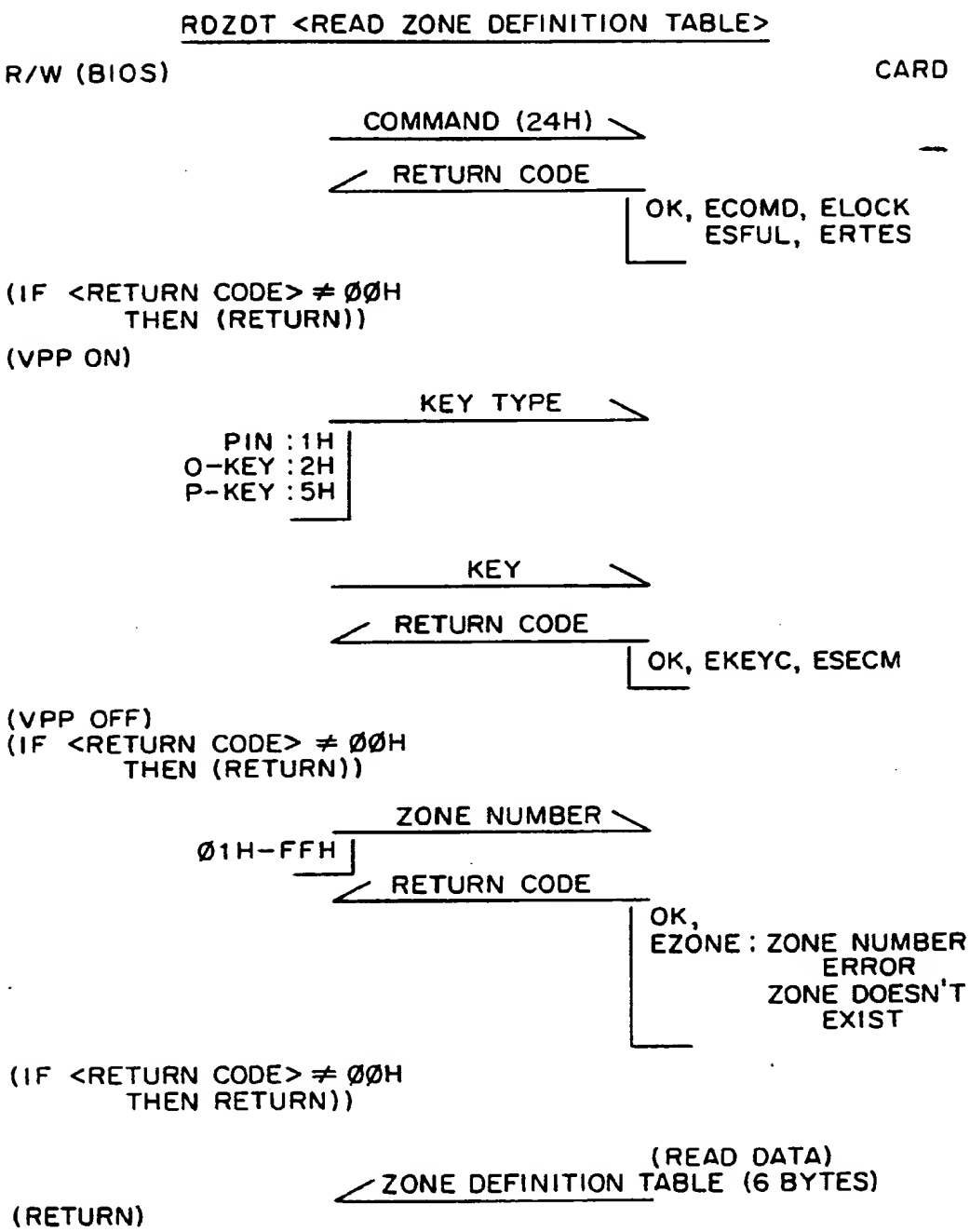

RDZDT <READ ZONE DEFINITION TABLE>
R/W (BIOS)
CARD
COMMAND (24H)
RETURN CODE
OK, ECOMD, ELOCK
ESFUL, ERTES
(IF <RETURN CODE> ≠ ØØH
THEN (RETURN))
(VPP ON)
KEY TYPE
PIN : 1H
O-KEY : 2H
P-KEY : 5H
KEY
RETURN CODE
OK, EKEYC, ESECM
(VPP OFF)
(IF <RETURN CODE> ≠ ØØH
THEN (RETURN))
ZONE NUMBER
Ø1H-FFH
RETURN CODE
OK,
EZONE : ZONE NUMBER
ERROR
ZONE DOESN'T
EXIST
(IF <RETURN CODE> ≠ ØØH
THEN RETURN))
(READ DATA)
ZONE DEFINITION TABLE (6 BYTES)
(RETURN)

FIG. 25

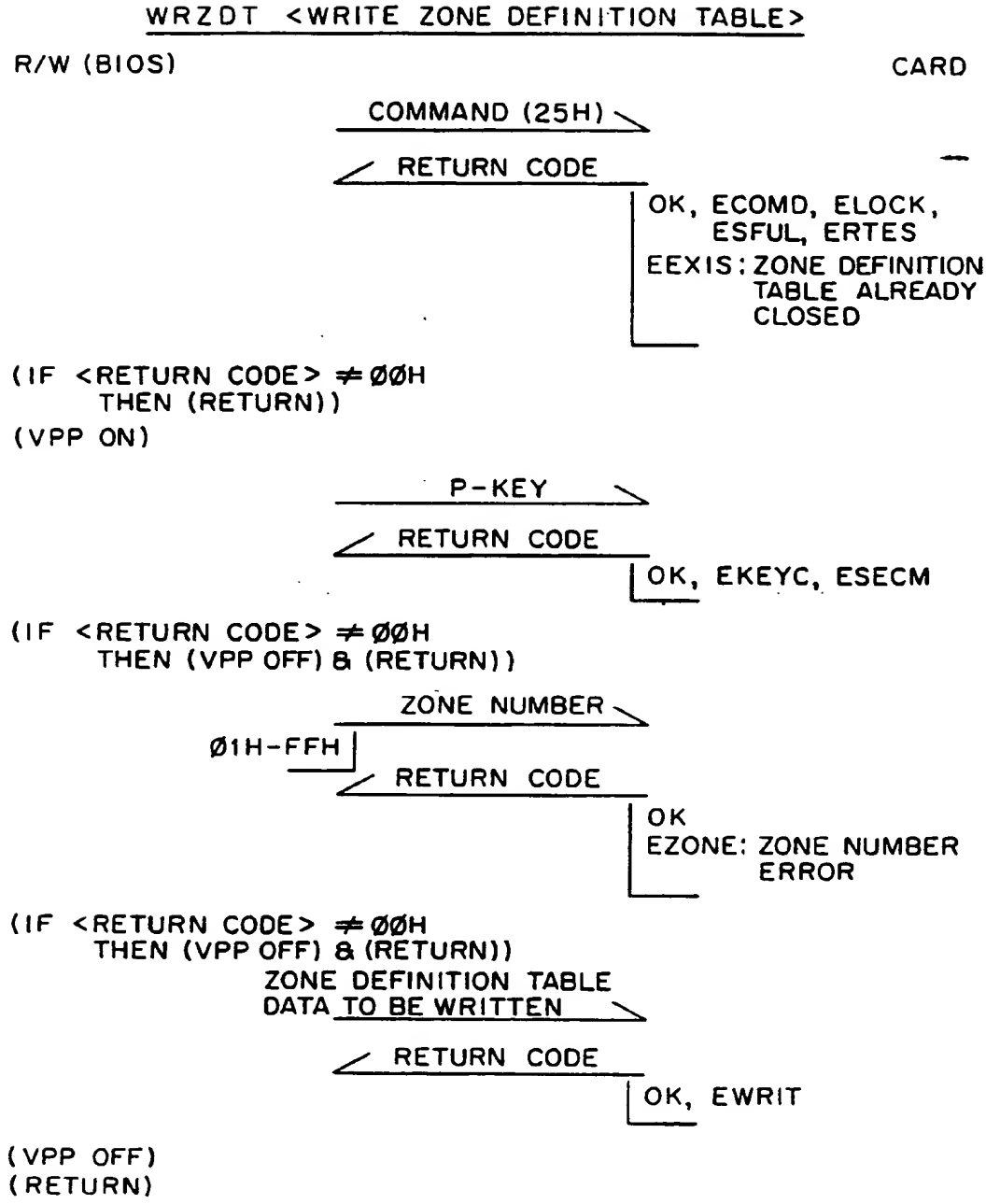

WRZDT <WRITE ZONE DEFINITION TABLE>
R/W (BIOS)
CARD
COMMAND (25H)
RETURN CODE
OK, ECOMD, ELOCK, ESFUL, ERTES
EEXIS: ZONE DEFINITION TABLE ALREADY CLOSED
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
(VPP ON)
P-KEY
RETURN CODE
OK, EKEYC, ESECM
(IF <RETURN CODE> ≠ ØØH THEN (VPP OFF) & (RETURN))
ZONE NUMBER
Ø1H-FFH
RETURN CODE
OK
EZONE: ZONE NUMBER ERROR
(IF <RETURN CODE> ≠ ØØH THEN (VPP OFF) & (RETURN))
ZONE DEFINITION TABLE DATA TO BE WRITTEN
RETURN CODE
OK, EWRIT
(VPP OFF)
(RETURN)

FIG. 26

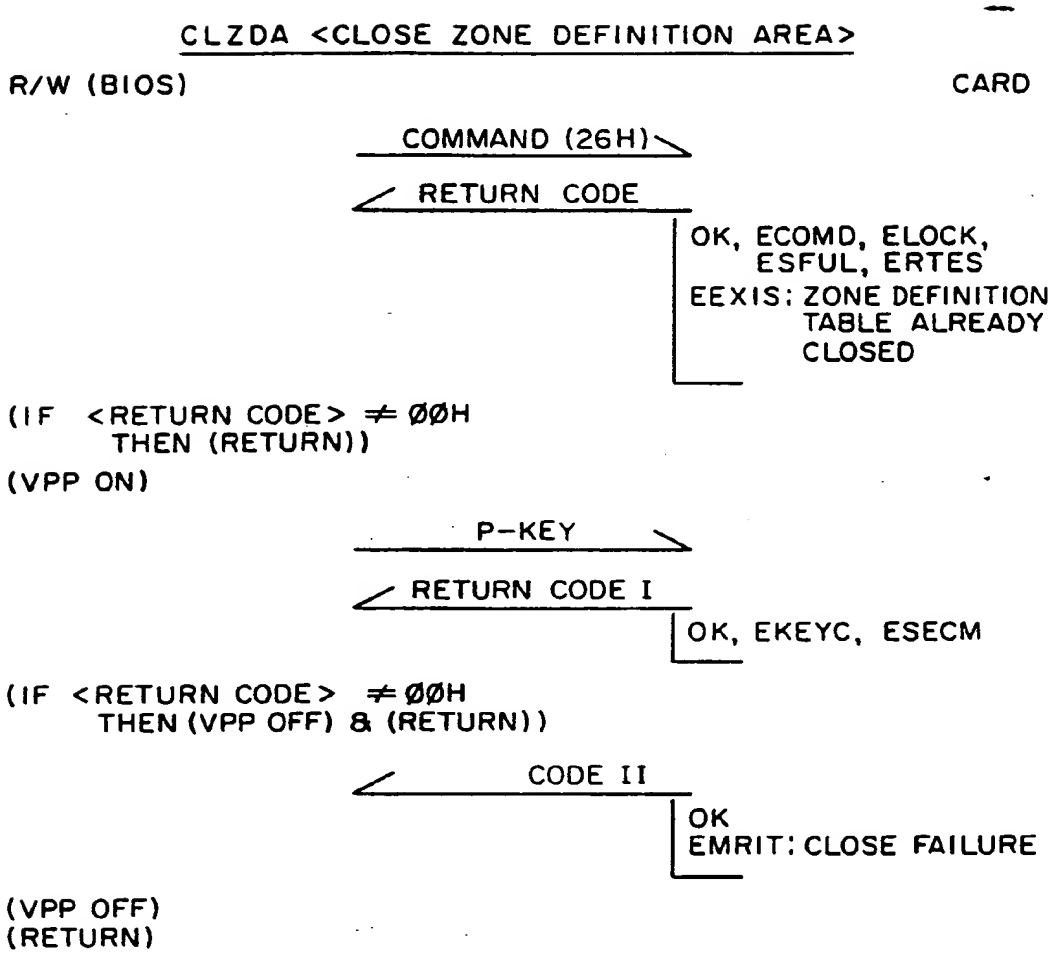

CLZDA <CLOSE ZONE DEFINITION AREA>
R/W (BIOS)
CARD
COMMAND (26H)
RETURN CODE
OK, ECOMD, ELOCK, ESFUL, ERTES
EEXIS: ZONE DEFINITION TABLE ALREADY CLOSED
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
(VPP ON)
P-KEY
RETURN CODE I
OK, EKEYC, ESECM
(IF <RETURN CODE> ≠ ØØH THEN (VPP OFF) & (RETURN))
CODE II
OK
EMRIT: CLOSE FAILURE
(VPP OFF)
(RETURN)

FIG. 27

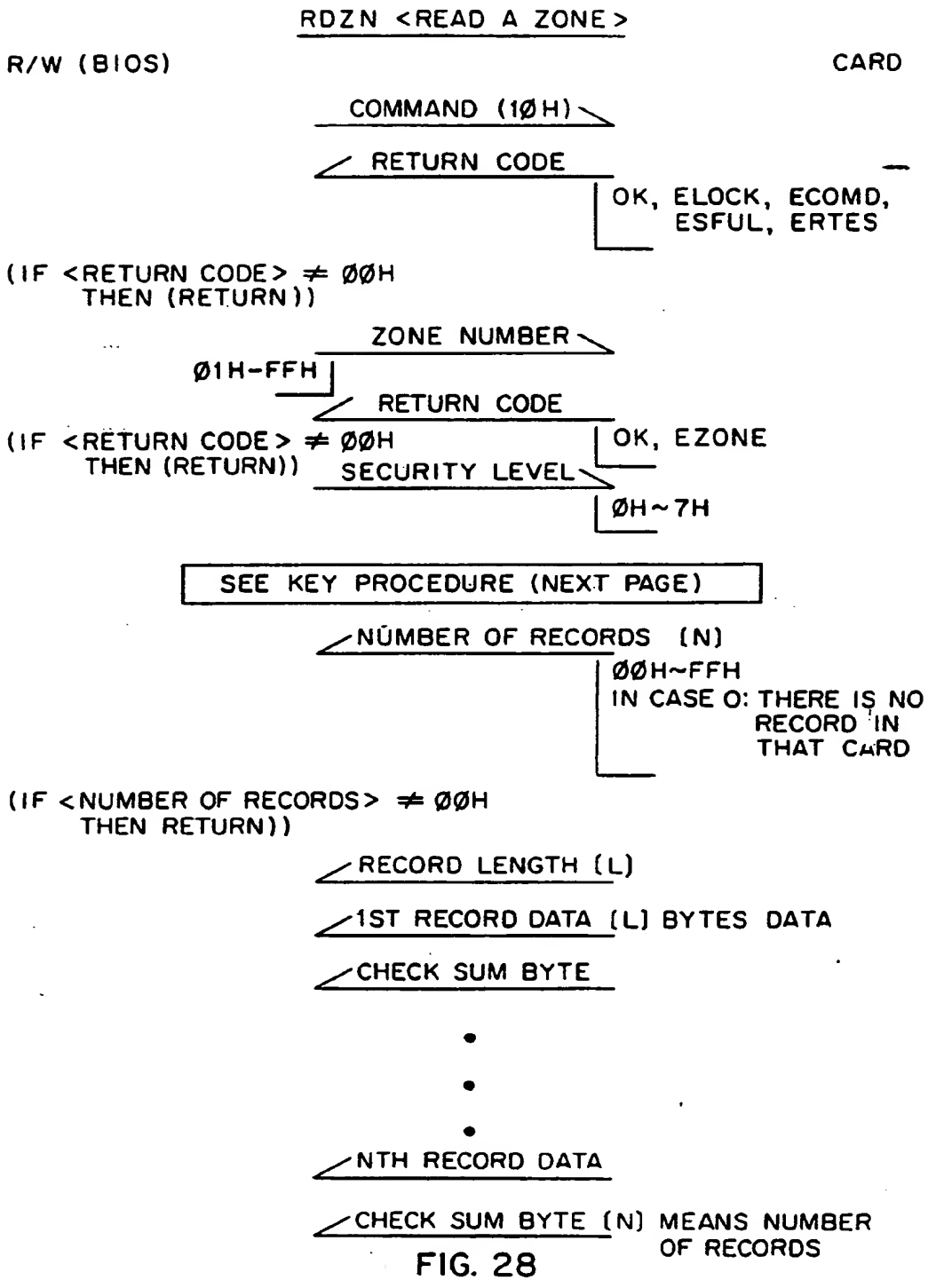

RDZN <READ A ZONE>
R/W (BIOS)
CARD
COMMAND (1ØH)
RETURN CODE
OK, ELOCK, ECOMD, ESFUL, ERTES
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
ZONE NUMBER
Ø1H-FFH
RETURN CODE
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
OK, EZONE
SECURITY LEVEL
ØH~7H
SEE KEY PROCEDURE (NEXT PAGE)
NUMBER OF RECORDS (N)
ØØH~FFH
IN CASE O: THERE IS NO RECORD IN THAT CARD
(IF <NUMBER OF RECORDS> ≠ ØØH THEN RETURN))
RECORD LENGTH (L)
1ST RECORD DATA (L) BYTES DATA
CHECK SUM BYTE
NTH RECORD DATA
CHECK SUM BYTE (N) MEANS NUMBER OF RECORDS

FIG. 28

<KEY PROCEDURE> R/W (BIOS) ROUTINE

SL: SECURITY LEVEL (FROM IC CARD)

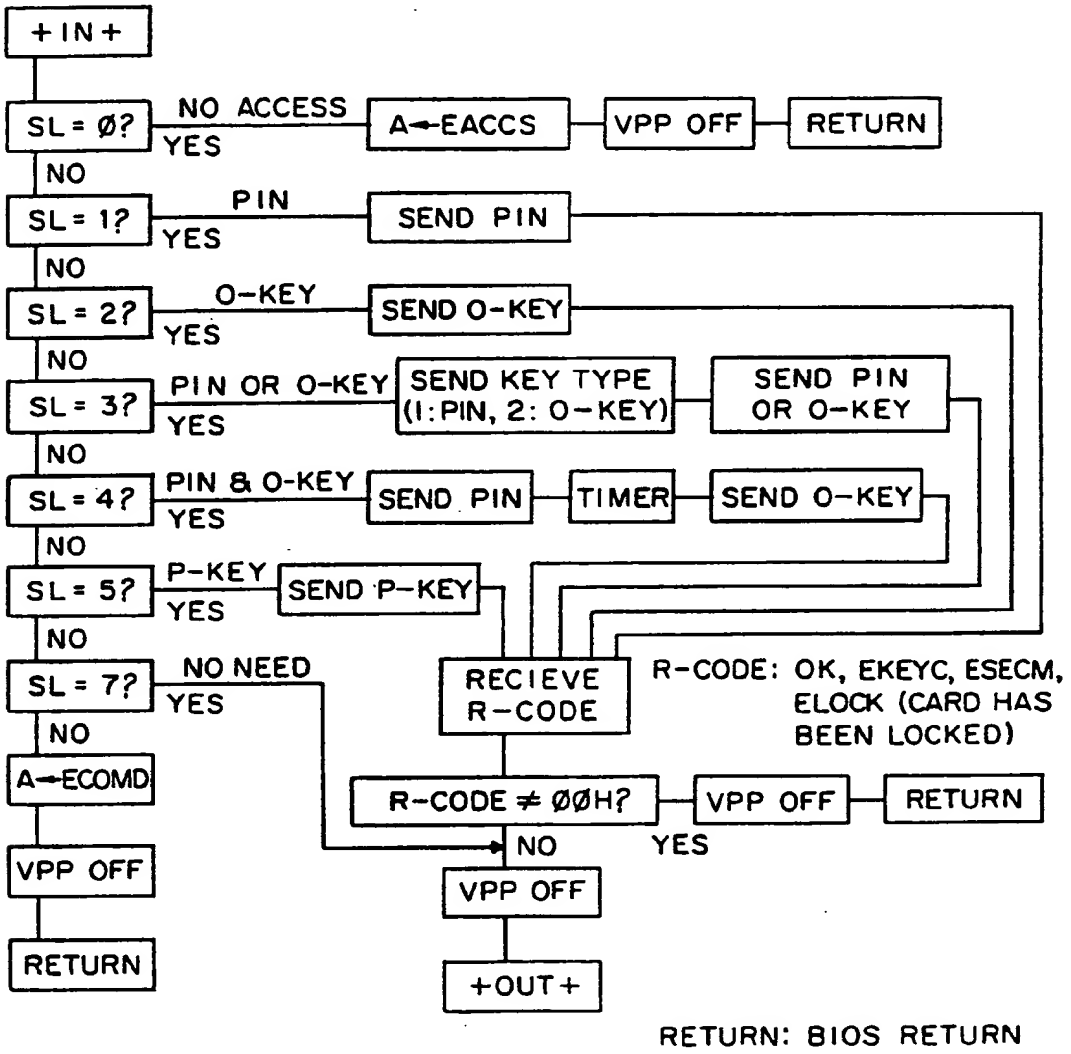


FIG. 29

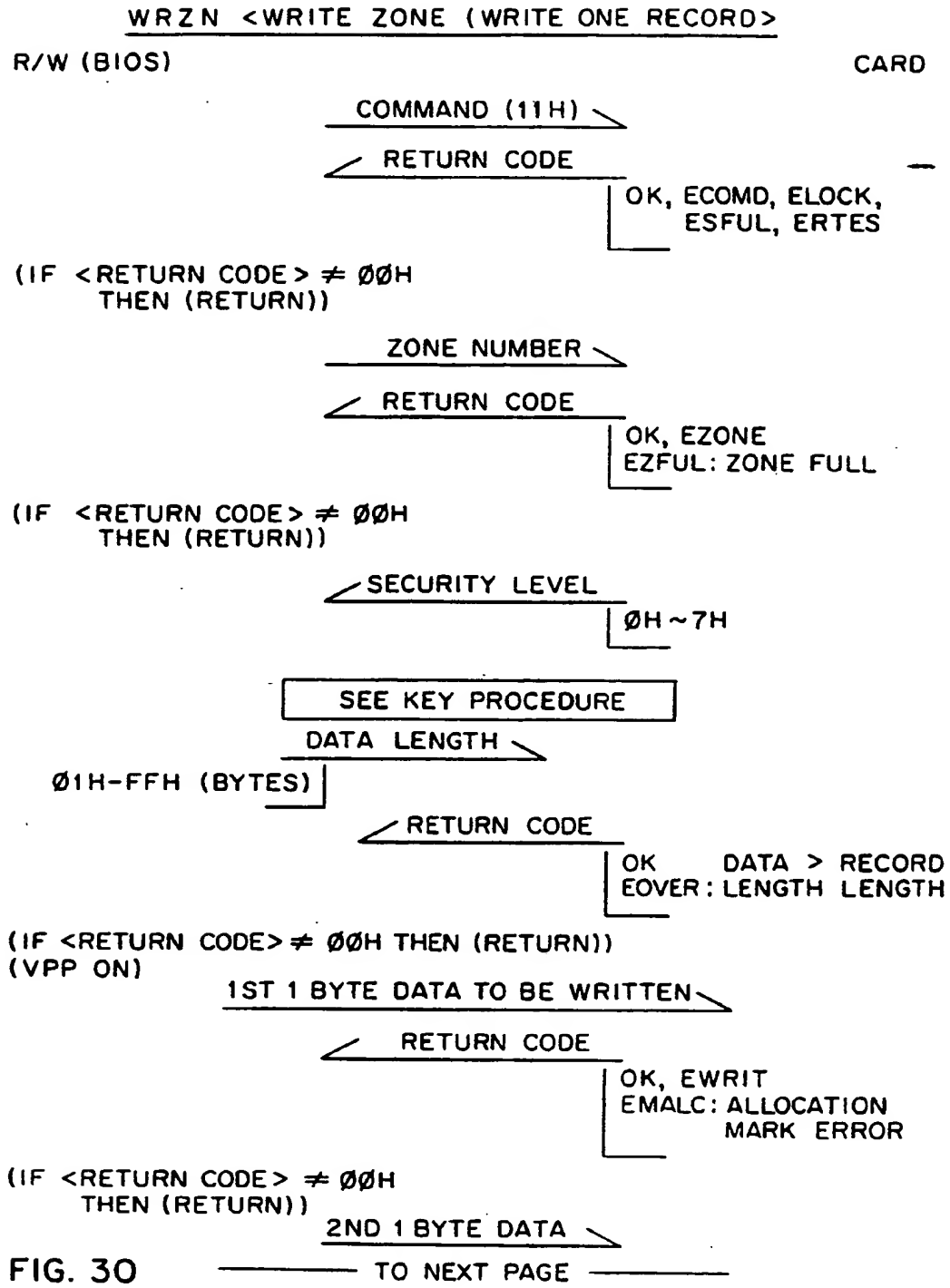

WRZN <WRITE ZONE (WRITE ONE RECORD>
R/W (BIOS)
CARD
COMMAND (11H)
RETURN CODE
OK, ECOMD, ELOCK, ESFUL, ERTES
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
ZONE NUMBER
RETURN CODE
OK, EZONE
EZFUL: ZONE FULL
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
SECURITY LEVEL
ØH~7H
SEE KEY PROCEDURE
DATA LENGTH
Ø1H-FFH (BYTES)
RETURN CODE
OK DATA > RECORD
EOVER: LENGTH LENGTH
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
(VPP ON)
1ST 1 BYTE DATA TO BE WRITTEN
RETURN CODE
OK, EWRIT
EMALC: ALLOCATION MARK ERROR
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
2ND 1 BYTE DATA
TO NEXT PAGE

FIG. 30

WRZN <WRITE ZONE (WRITE 1 RECORD)>

—————FROM BEFORE PAGE —————

RETURN CODE
- OK, EWRIT

(IF <RETURN CODE> ≠ ØØH
THEN (VPP OFF) & RETURN

•
•
•
•

NTH 1 BYTE DATA

RETURN CODE
- OK, EWRIT

RETURN CODE
- OK, EWRIT
  CHECK SUM WRITE RESULT

(VPP OFF)
(RETURN)

FIG. 31

WRZNWV <WRITE ZONE WITH VERIFY>

R/W (BIOS) CARD

SAME AS WRZN COMMAND

COMMAND = (11H)

(IF <RETURN CODE> ≠ ØØH
THEN (VPP OFF) & (RETURN))

RECORD LENGTH (L)

DATA (L BYTES)

CHECK SUM

(R/W ERROR CHECK)
ERROR CASE

ECHEK : CHECK SUM ERROR
EVEFY : VERIFY ERROR

(RETURN)

FIG. 32

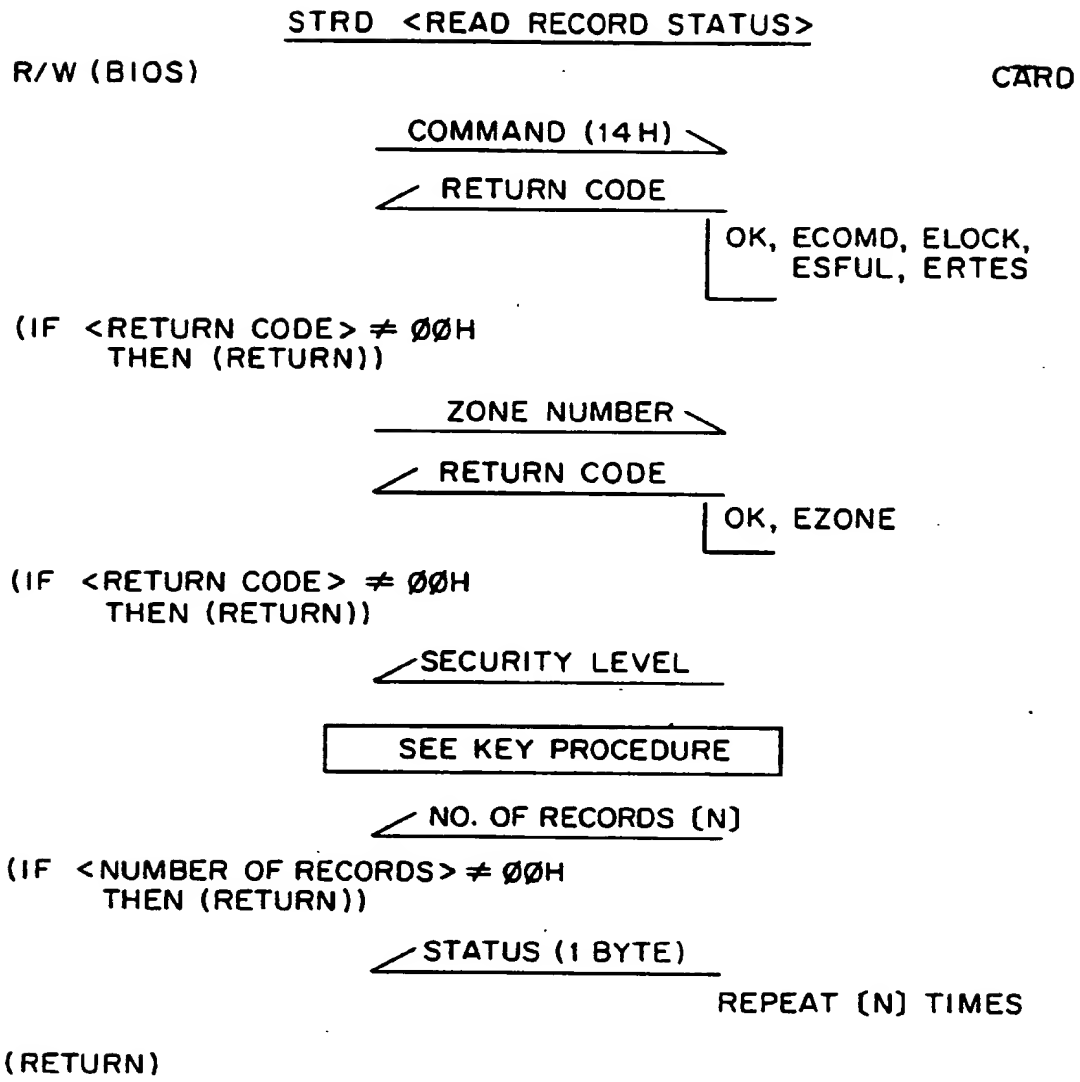

STRD <READ RECORD STATUS>
R/W (BIOS)
CARD
COMMAND (14H)
RETURN CODE
OK, ECOMD, ELOCK, ESFUL, ERTES
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
ZONE NUMBER
RETURN CODE
OK, EZONE
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
SECURITY LEVEL
SEE KEY PROCEDURE
NO. OF RECORDS (N)
(IF <NUMBER OF RECORDS> ≠ ØØH THEN (RETURN))
STATUS (1 BYTE)
REPEAT (N) TIMES
(RETURN)

FIG. 33

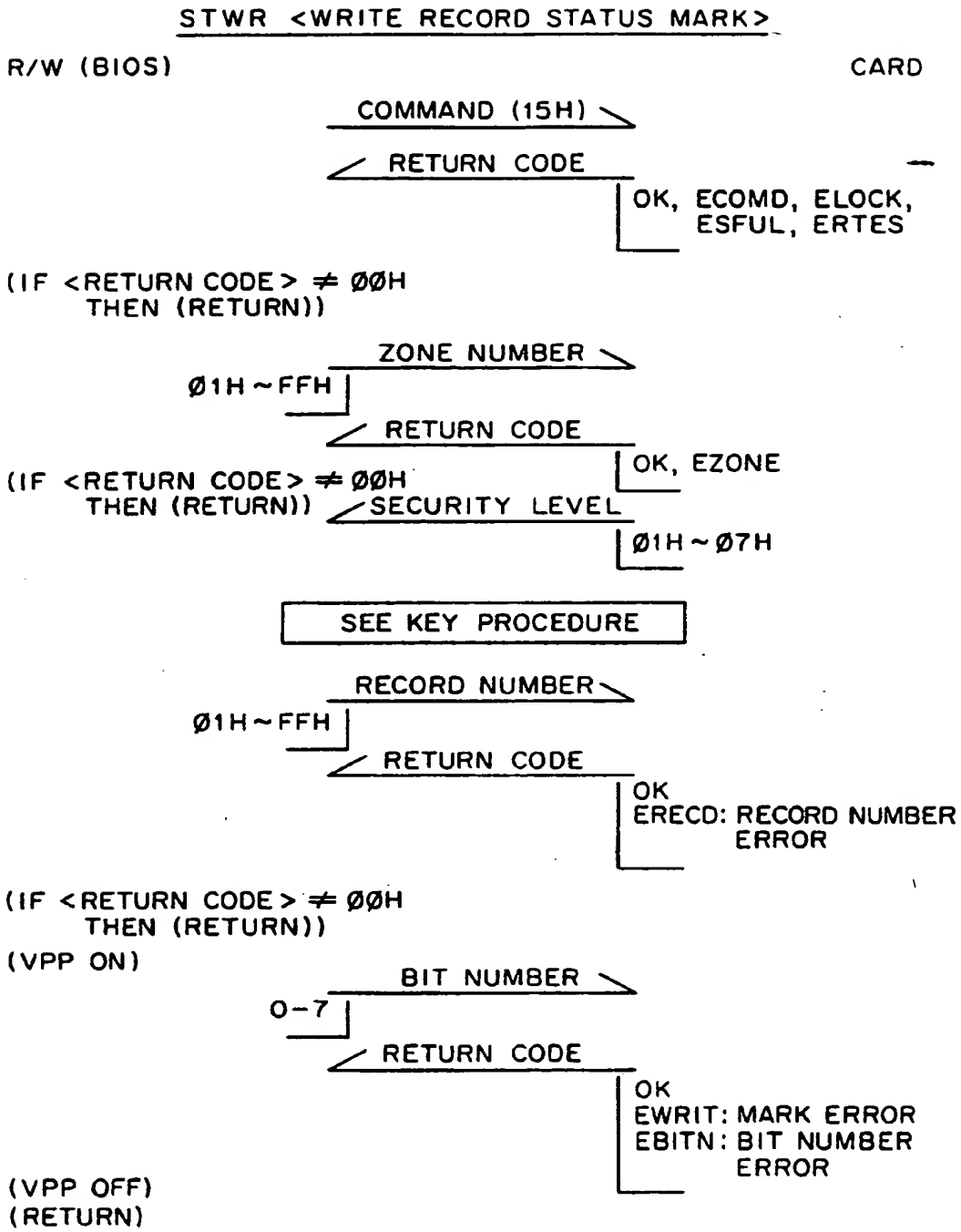

STWR <WRITE RECORD STATUS MARK>
R/W (BIOS)
CARD
COMMAND (15H)
RETURN CODE
OK, ECOMD, ELOCK, ESFUL, ERTES
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
ZONE NUMBER
Ø1H ~ FFH
RETURN CODE
OK, EZONE
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
SECURITY LEVEL
Ø1H ~ Ø7H
SEE KEY PROCEDURE
RECORD NUMBER
Ø1H ~ FFH
RETURN CODE
OK
ERECD: RECORD NUMBER ERROR
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
(VPP ON)
BIT NUMBER
0-7
RETURN CODE
OK
EWRIT: MARK ERROR
EBITN: BIT NUMBER ERROR
(VPP OFF)
(RETURN)

FIG. 34

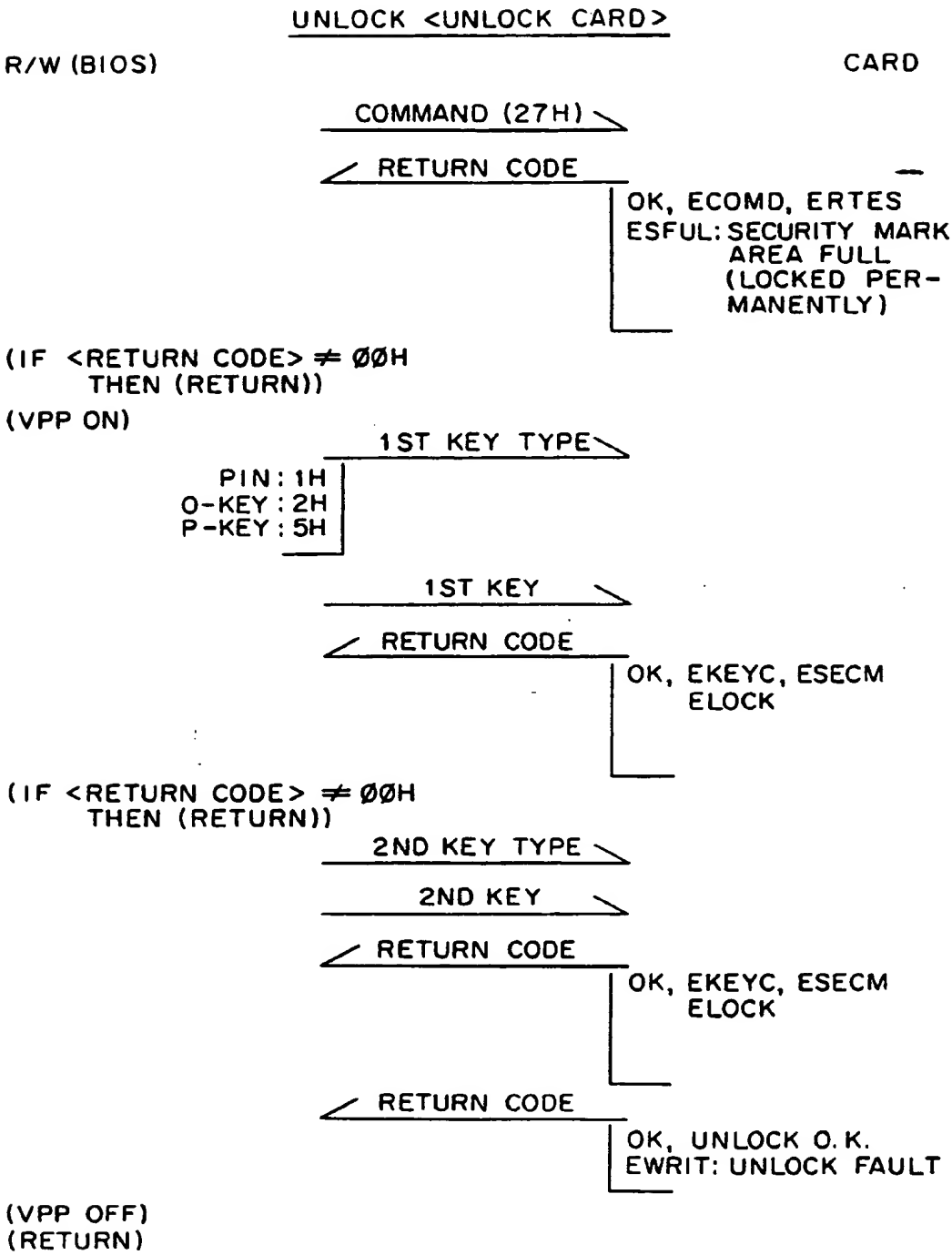

UNLOCK <UNLOCK CARD>
R/W (BIOS)
CARD
COMMAND (27H)
RETURN CODE
OK, ECOMD, ERTES
ESFUL: SECURITY MARK AREA FULL (LOCKED PERMANENTLY)
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
(VPP ON)
1ST KEY TYPE
PIN: 1H
O-KEY: 2H
P-KEY: 5H
1ST KEY
RETURN CODE
OK, EKEYC, ESECM ELOCK
(IF <RETURN CODE> ≠ ØØH THEN (RETURN))
2ND KEY TYPE
2ND KEY
RETURN CODE
OK, EKEYC, ESECM ELOCK
RETURN CODE
OK, UNLOCK O.K.
EWRIT: UNLOCK FAULT
(VPP OFF)
(RETURN)

FIG. 35

REMAIN <NUMBER OF REMAINING RECORDS>

R/W (BIOS) CARD

COMMAND (28H) →

← RETURN CODE
OK, ECOMD, ELOCK, ESFUL, ERTES

(IF <RETURN CODE> ≠ ØØH
THEN (RETURN))

ZONE NUMBER →

← RETURN CODE
OK, EZONE

(IF <RETURN CODE> ≠ ØØH
THEN (RETURN))

← SECURITY LEVEL
ØH ~ 7H

SEE KEY PROCEDURE

← NUMBER OF REMAINING RECORDS
(ØØH ~ FFH)

(RETURN)

FIG. 36

MTEST <TEST AT MANUFACTURING>

R/W (BIOS) CARD

COMMAND (3ØH) →

← ANSWER (USUALLY SAME COMMAND
ECOMD: COMMAND ERROR

(IF <ANSWER> ≠ <COMMAND>
THEN (RETURN))

(VPP ON)

COMMAND →

← RESULT
OK, ECOMD
EWRIT: TEST WRITE ERROR
EBLNK: CARD BLANK ERROR

(VPP OFF)
(RETURN)

FIG. 37

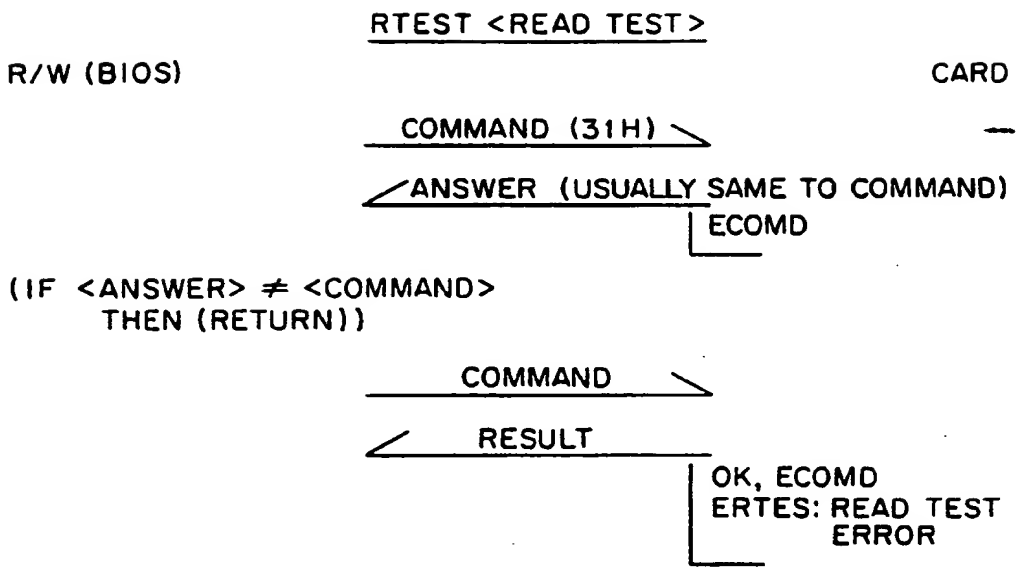

RTEST <READ TEST>
R/W (BIOS)
CARD
COMMAND (31H)
ANSWER (USUALLY SAME TO COMMAND)
ECOMD
(IF <ANSWER> ≠ <COMMAND>
THEN (RETURN))
COMMAND
RESULT
OK, ECOMD
ERTES: READ TEST
ERROR
(RETURN)

FIG. 38

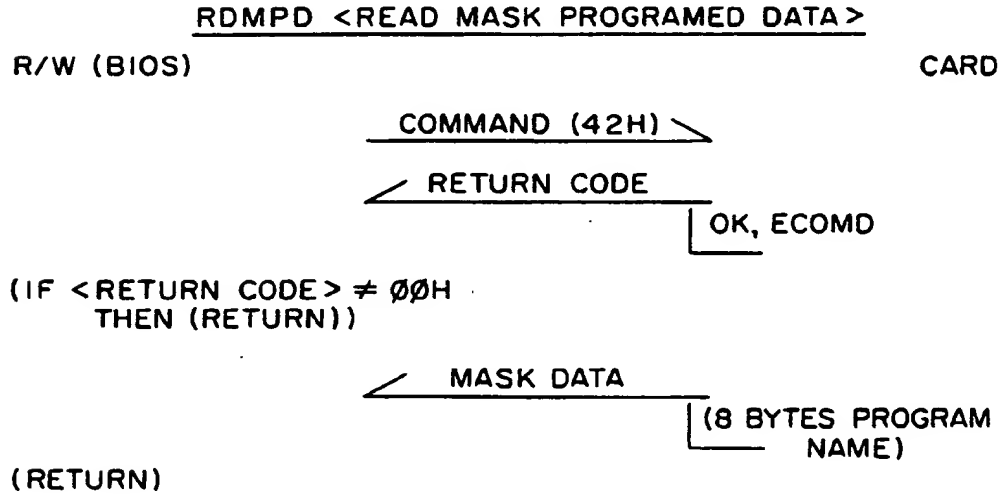

RDMPD <READ MASK PROGRAMED DATA>
R/W (BIOS)
CARD
COMMAND (42H)
RETURN CODE
OK, ECOMD
(IF <RETURN CODE> ≠ ØØH
THEN (RETURN))
MASK DATA
(8 BYTES PROGRAM
NAME)
(RETURN)

FIG. 39

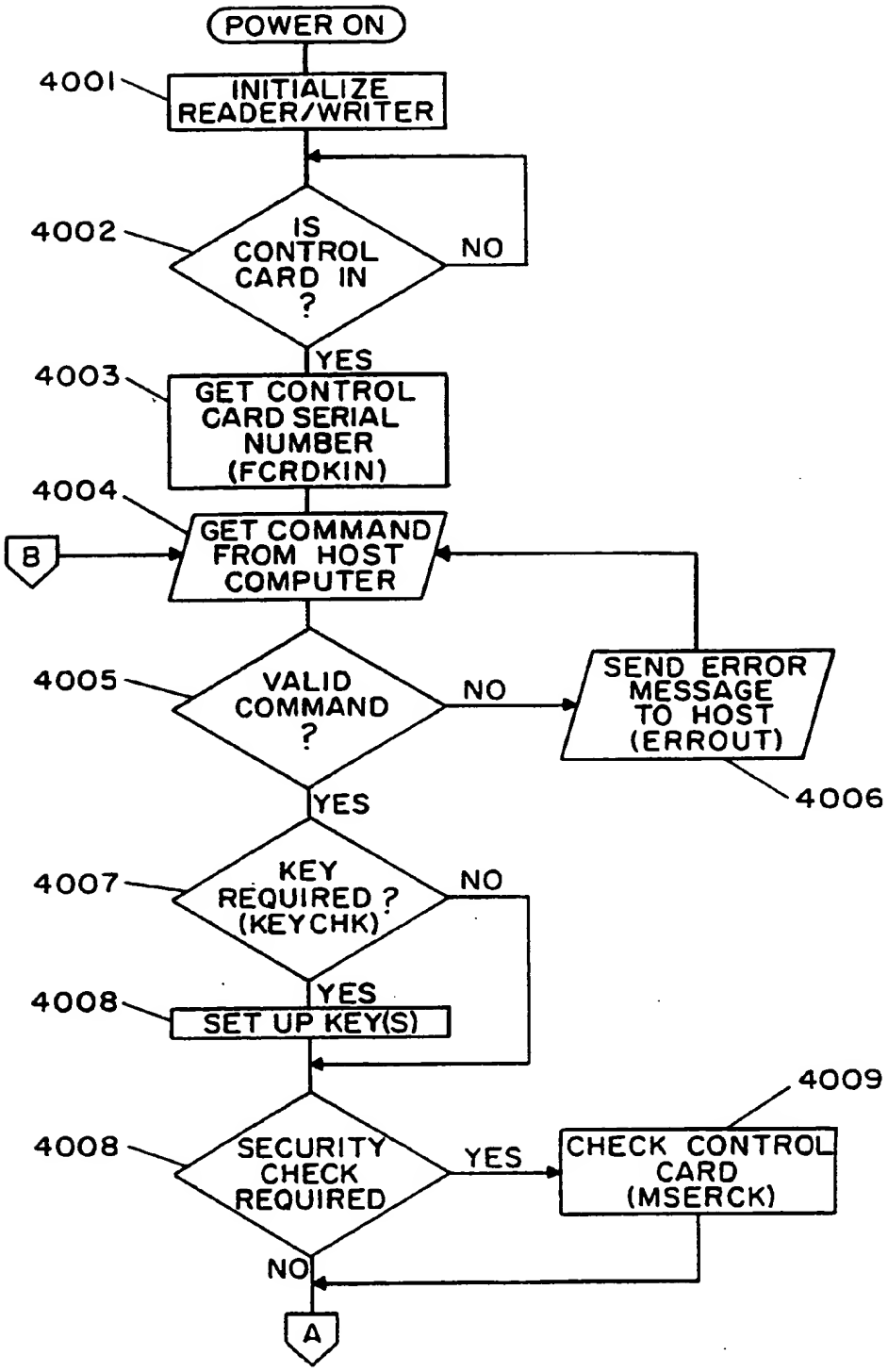

POWER ON
4001
INITIALIZE READER/WRITER
4002
IS CONTROL CARD IN ?
NO
YES
4003
GET CONTROL CARD SERIAL NUMBER (FCRDKIN)
4004
B
GET COMMAND FROM HOST COMPUTER
4005
VALID COMMAND ?
NO
SEND ERROR MESSAGE TO HOST (ERROUT)
4006
YES
4007
KEY REQUIRED ? (KEYCHK)
NO
YES
4008
SET UP KEY(S)
4009
4008
SECURITY CHECK REQUIRED
YES
CHECK CONTROL CARD (MSERCK)
NO
A

FIG.40A

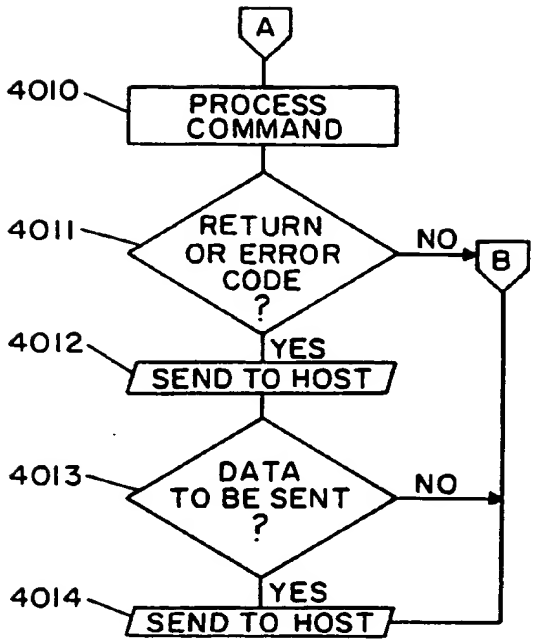
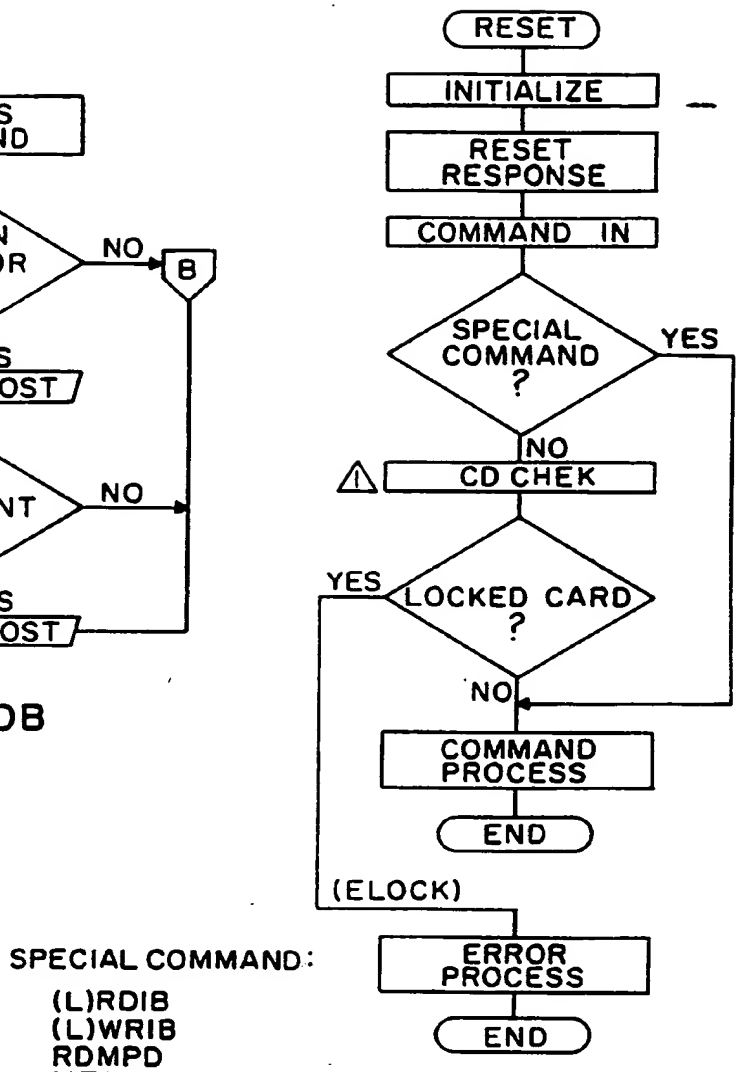


FIG. 40B



SPECIAL COMMAND:

(L)RDIB
(L)WRIB
RDMPD
MTEST
RTEST
UNLOCK

FIG. 41

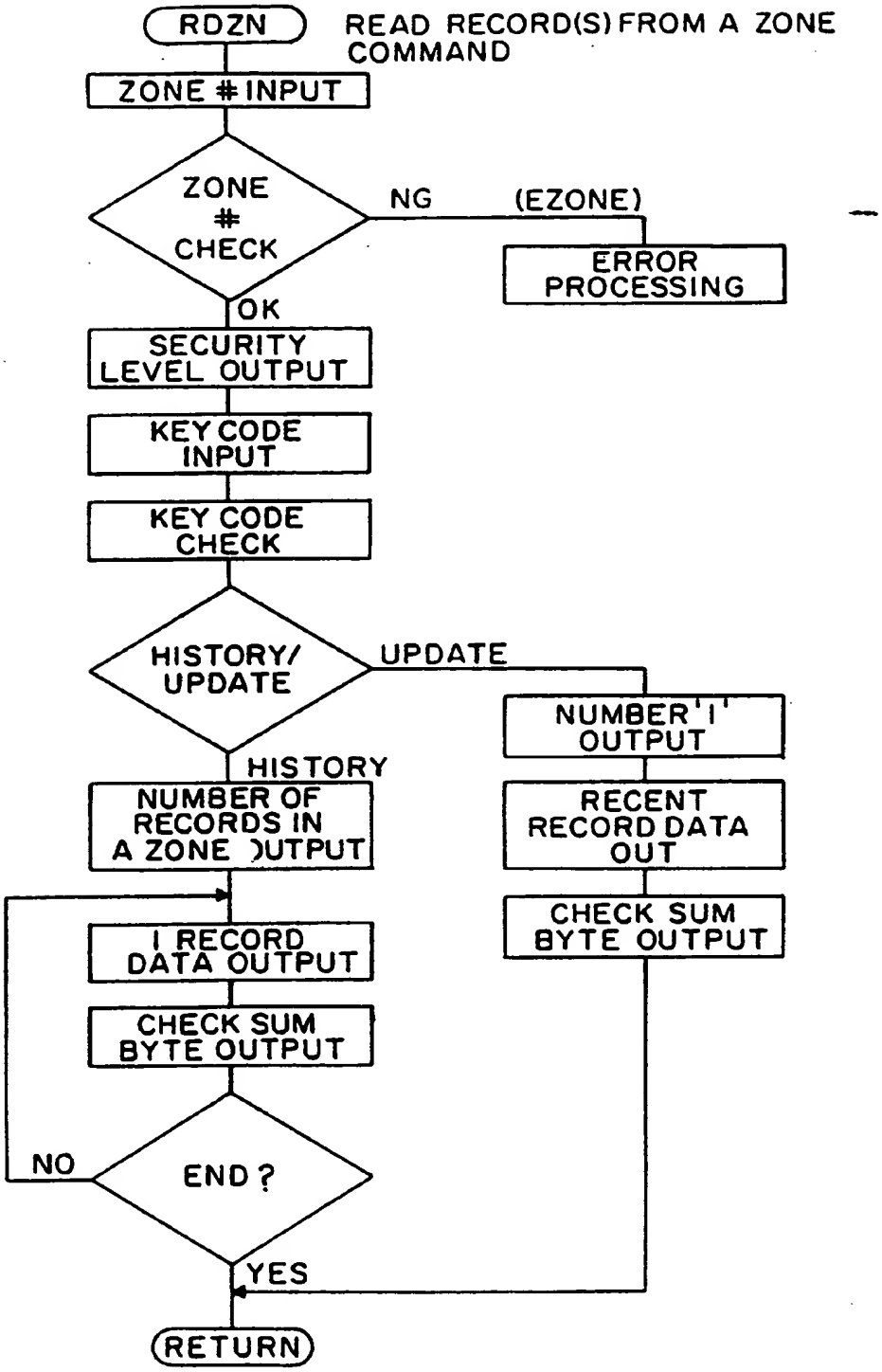

RDZN
READ RECORD(S) FROM A ZONE COMMAND
ZONE # INPUT
ZONE # CHECK
NG
(EZONE)
ERROR PROCESSING
OK
SECURITY LEVEL OUTPUT
KEY CODE INPUT
KEY CODE CHECK
HISTORY/ UPDATE
UPDATE
NUMBER 'I' OUTPUT
RECENT RECORD DATA OUT
CHECK SUM BYTE OUTPUT
HISTORY
NUMBER OF RECORDS IN A ZONE OUTPUT
I RECORD DATA OUTPUT
CHECK SUM BYTE OUTPUT
NO
END ?
YES
RETURN

FIG.42

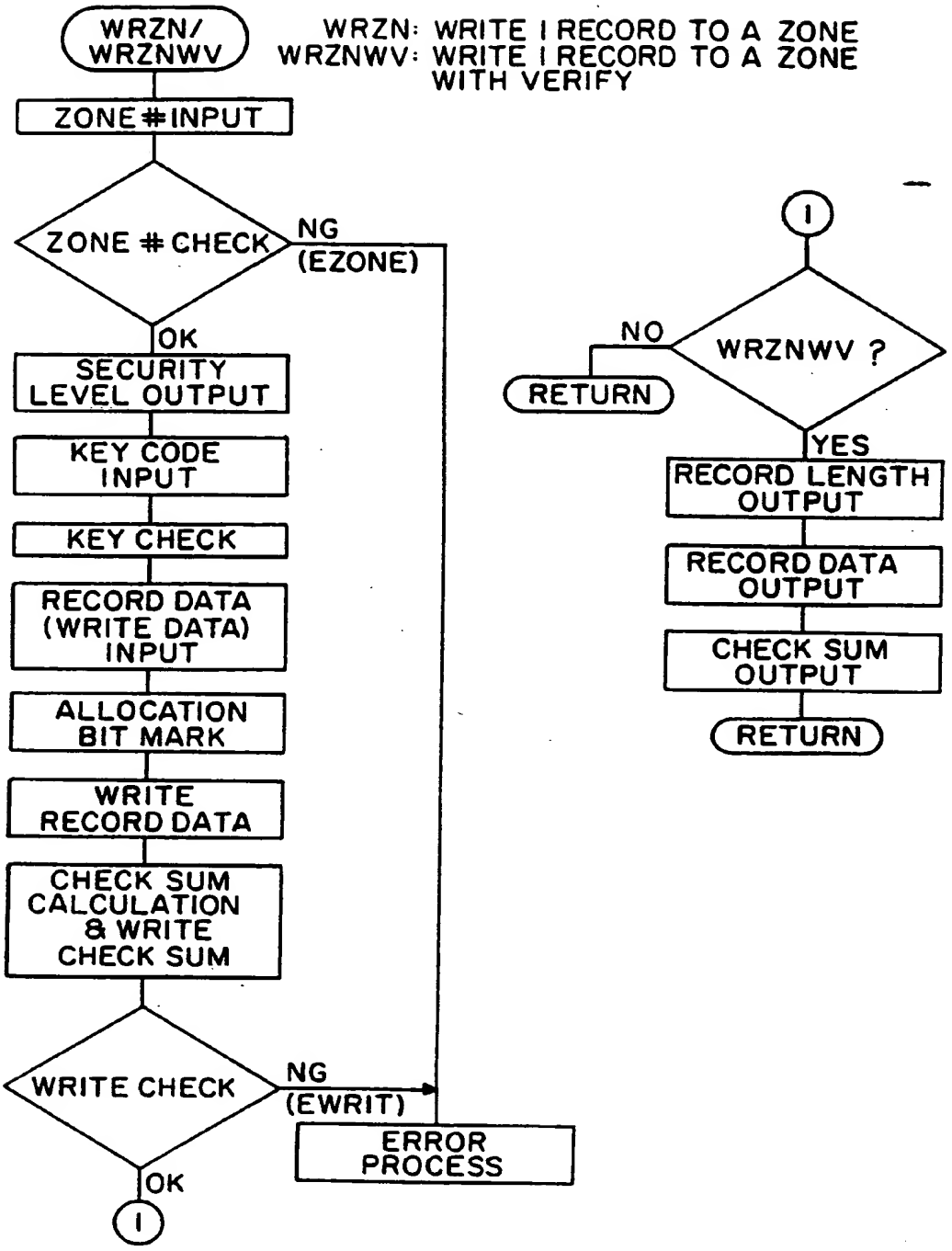

WRZN/
WRZNWV
WRZN: WRITE I RECORD TO A ZONE
WRZNWV: WRITE I RECORD TO A ZONE
WITH VERIFY
ZONE#INPUT
ZONE # CHECK
NG
(EZONE)
OK
SECURITY
LEVEL OUTPUT
KEY CODE
INPUT
KEY CHECK
RECORD DATA
(WRITE DATA)
INPUT
ALLOCATION
BIT MARK
WRITE
RECORD DATA
CHECK SUM
CALCULATION
& WRITE
CHECK SUM
WRITE CHECK
NG
(EWRIT)
ERROR
PROCESS
OK
I
I
NO
WRZNWV ?
RETURN
YES
RECORD LENGTH
OUTPUT
RECORD DATA
OUTPUT
CHECK SUM
OUTPUT
RETURN

FIG. 43

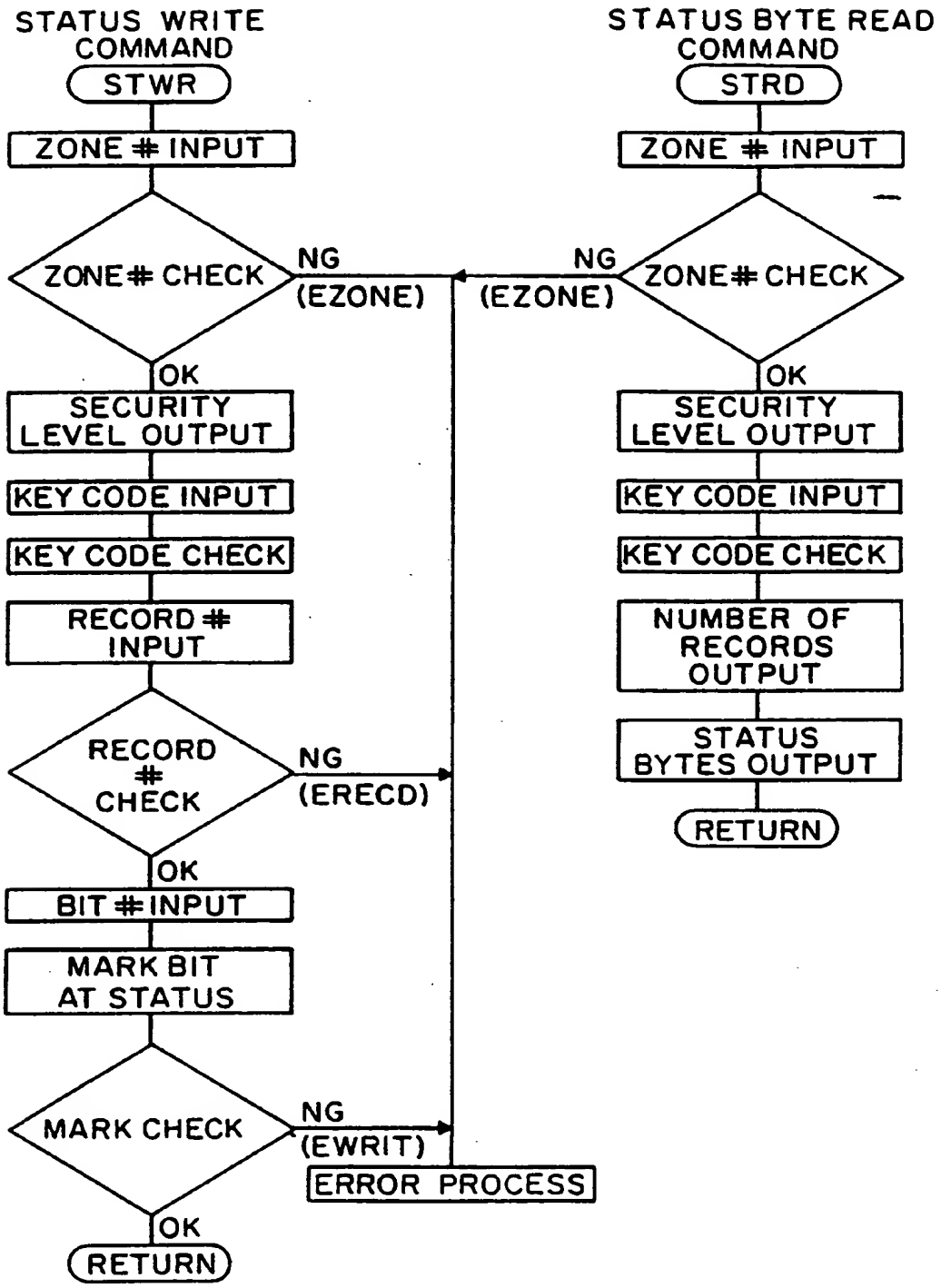

STATUS WRITE COMMAND
STWR
ZONE # INPUT
ZONE # CHECK
NG
(EZONE)
OK
SECURITY LEVEL OUTPUT
KEY CODE INPUT
KEY CODE CHECK
RECORD # INPUT
RECORD # CHECK
NG
(ERECD)
OK
BIT # INPUT
MARK BIT AT STATUS
MARK CHECK
NG
(EWRIT)
OK
RETURN
ERROR PROCESS
STATUS BYTE READ COMMAND
STRD
ZONE # INPUT
ZONE # CHECK
NG
(EZONE)
OK
SECURITY LEVEL OUTPUT
KEY CODE INPUT
KEY CODE CHECK
NUMBER OF RECORDS OUTPUT
STATUS BYTES OUTPUT
RETURN

FIG. 44

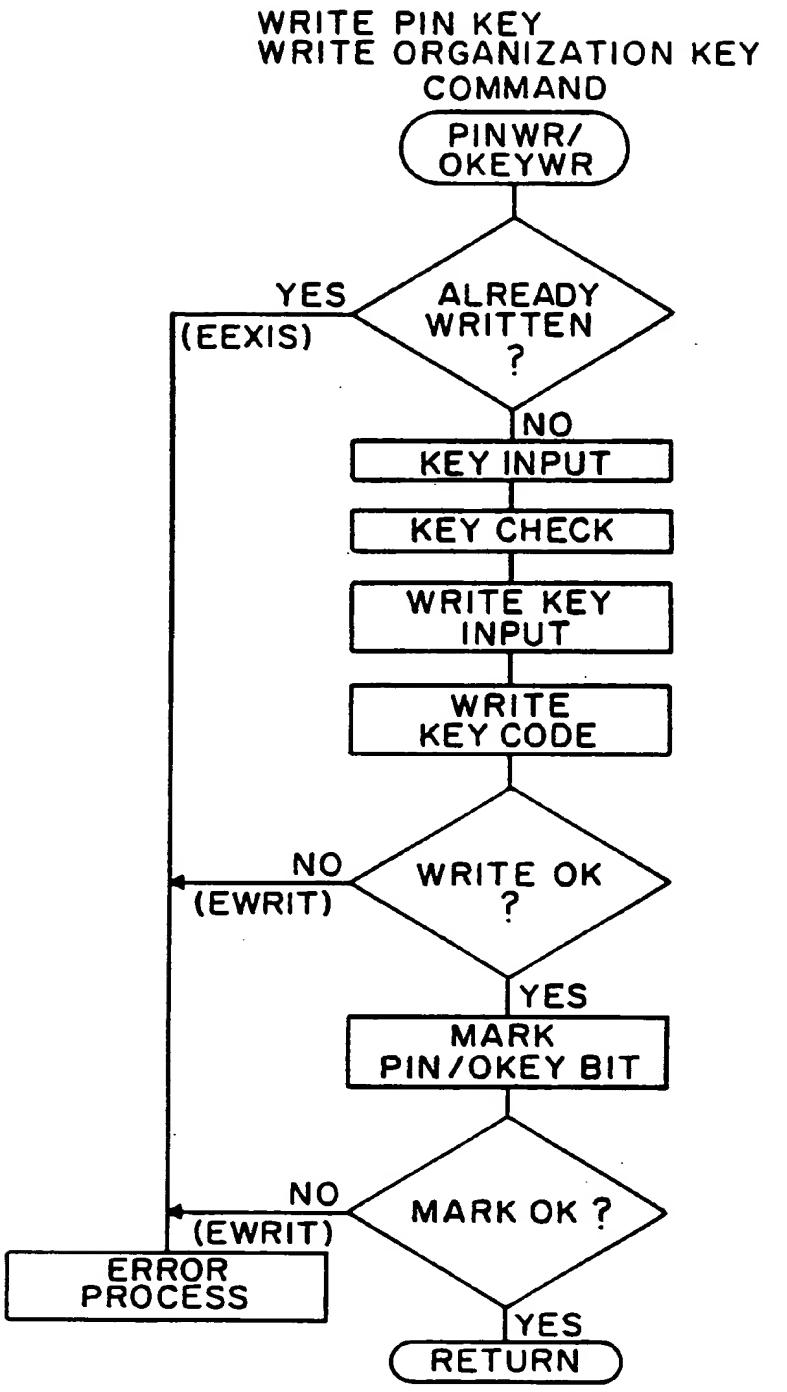

WRITE PIN KEY
WRITE ORGANIZATION KEY
COMMAND
PINWR/
OKEYWR
YES
(EEXIS)
ALREADY
WRITTEN
?
NO
KEY INPUT
KEY CHECK
WRITE KEY
INPUT
WRITE
KEY CODE
NO
(EWRIT)
WRITE OK
?
YES
MARK
PIN/OKEY BIT
NO
(EWRIT)
MARK OK ?
ERROR
PROCESS
YES
RETURN

FIG. 45

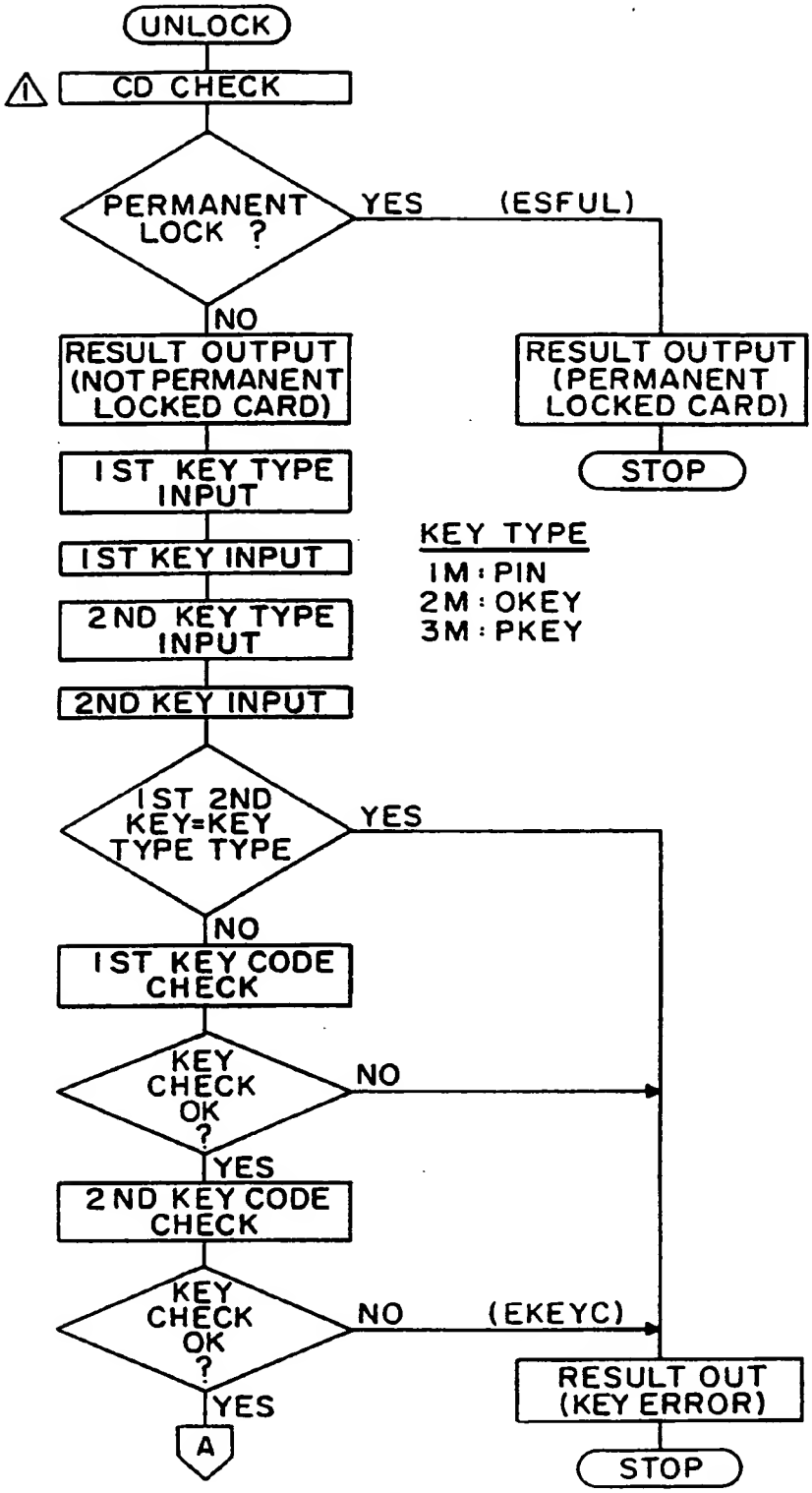

UNLOCK
1
CD CHECK
PERMANENT LOCK ?
YES
(ESFUL)
NO
RESULT OUTPUT (NOT PERMANENT LOCKED CARD)
RESULT OUTPUT (PERMANENT LOCKED CARD)
STOP
1ST KEY TYPE INPUT
1ST KEY INPUT
2ND KEY TYPE INPUT
2ND KEY INPUT
KEY TYPE
1M : PIN
2M : OKEY
3M : PKEY
1ST 2ND KEY=KEY TYPE TYPE
YES
NO
1ST KEY CODE CHECK
KEY CHECK OK ?
NO
YES
2ND KEY CODE CHECK
KEY CHECK OK ?
NO
(EKEYC)
YES
A
RESULT OUT (KEY ERROR)
STOP

FIG.46

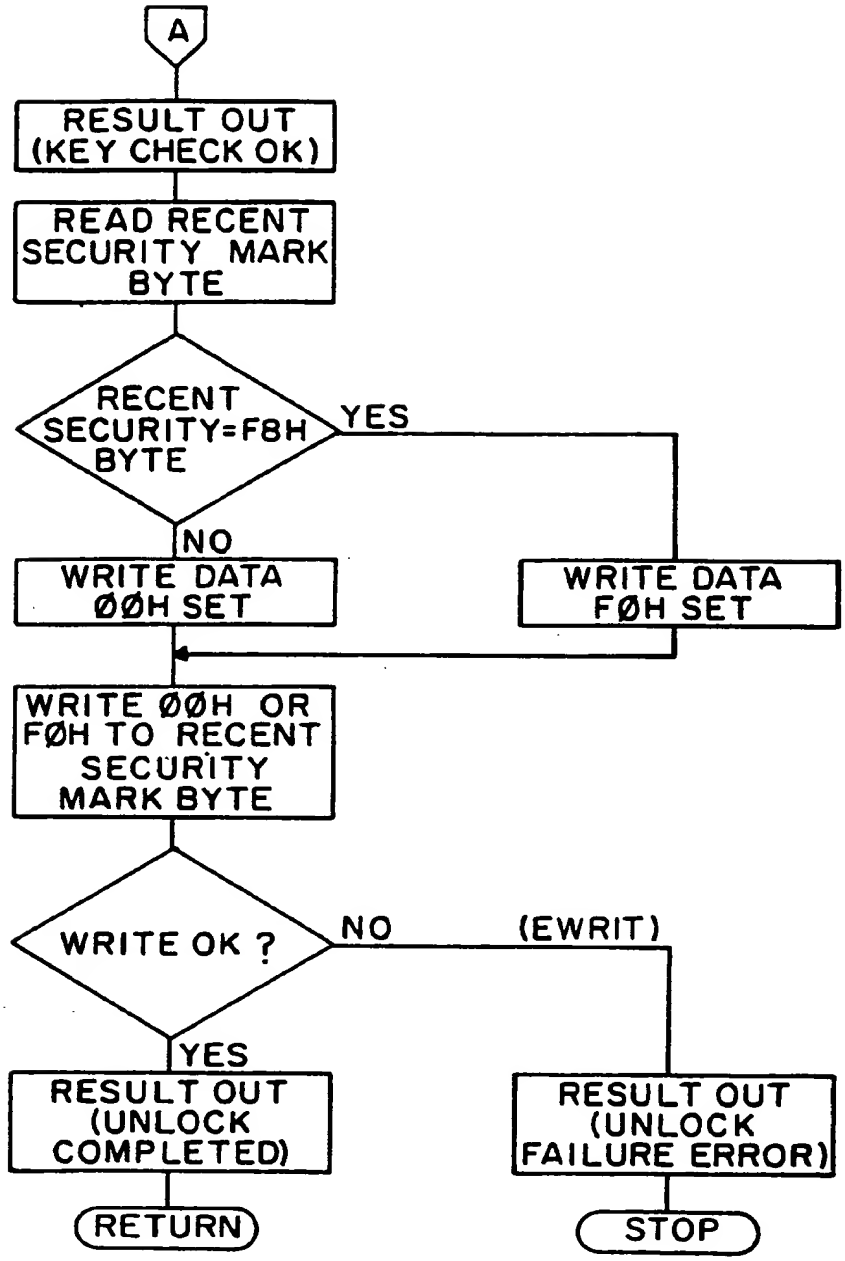

A
RESULT OUT (KEY CHECK OK)
READ RECENT SECURITY MARK BYTE
RECENT SECURITY=F8H BYTE
YES
NO
WRITE DATA ØØH SET
WRITE DATA FØH SET
WRITE ØØH OR FØH TO RECENT SECURITY MARK BYTE
WRITE OK ?
NO
(EWRIT)
YES
RESULT OUT (UNLOCK COMPLETED)
RESULT OUT (UNLOCK FAILURE ERROR)
RETURN
STOP

FIG. 47

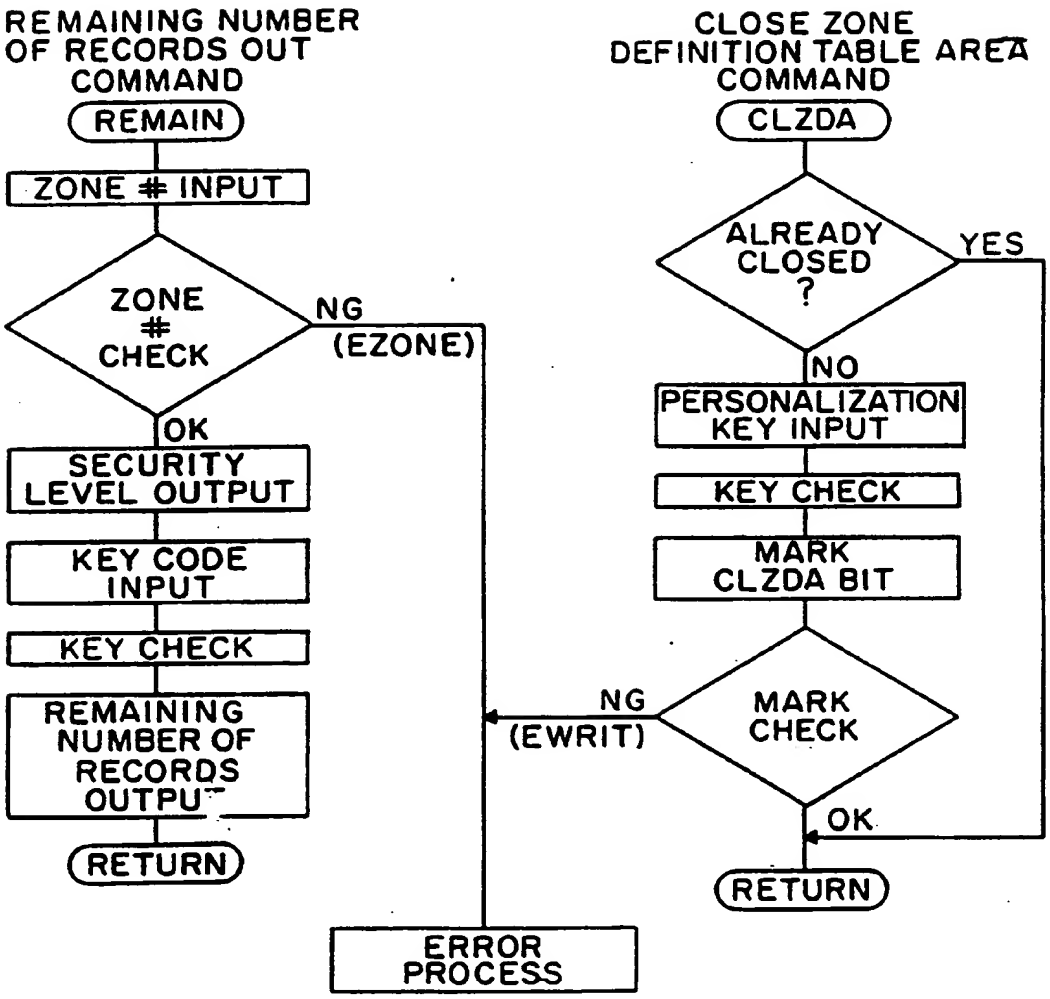

REMAINING NUMBER OF RECORDS OUT COMMAND
REMAIN
ZONE # INPUT
ZONE # CHECK
NG
(EZONE)
OK
SECURITY LEVEL OUTPUT
KEY CODE INPUT
KEY CHECK
REMAINING NUMBER OF RECORDS OUTPUT
RETURN
CLOSE ZONE DEFINITION TABLE AREA COMMAND
CLZDA
ALREADY CLOSED ?
YES
NO
PERSONALIZATION KEY INPUT
KEY CHECK
MARK CLZDA BIT
MARK CHECK
NG
(EWRIT)
OK
RETURN
ERROR PROCESS

FIG. 48

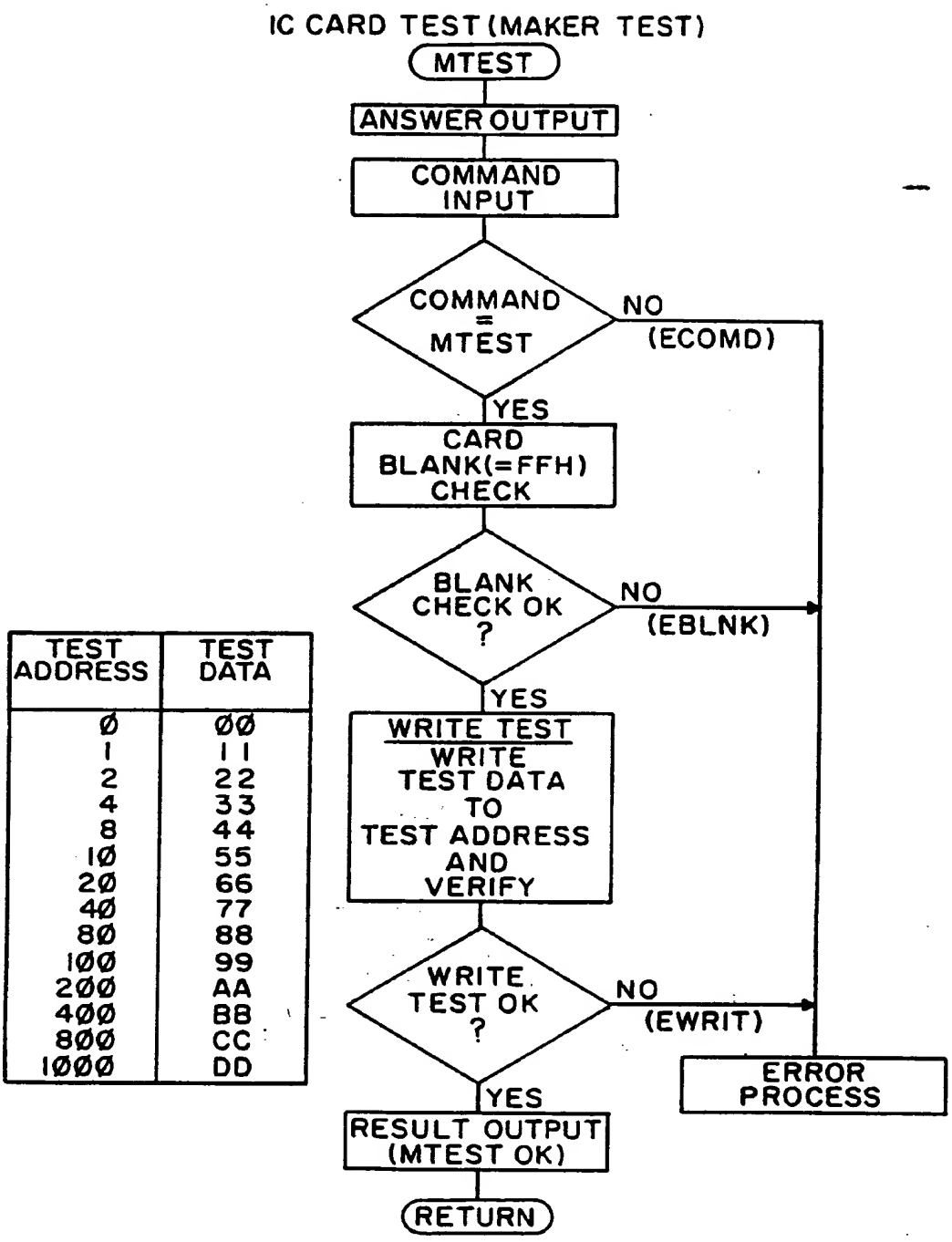

IC CARD TEST (MAKER TEST)
MTEST
ANSWER OUTPUT
COMMAND INPUT
COMMAND = MTEST
NO
(ECOMD)
YES
CARD BLANK(=FFH) CHECK
BLANK CHECK OK ?
NO
(EBLNK)
YES
WRITE TEST
WRITE TEST DATA TO TEST ADDRESS AND VERIFY
WRITE TEST OK ?
NO
(EWRIT)
YES
ERROR PROCESS
RESULT OUTPUT (MTEST OK)
RETURN
TEST ADDRESS
TEST DATA
Ø ØØ
1 11
2 22
4 33
8 44
10 55
20 66
40 77
80 88
100 99
200 AA
400 BB
800 CC
1000 DD

FIG. 49